Nov. 1979
$1.40* NZ $1.60

eti ELECTRONICS TODAY INTERNATIONAL

Build our electronic tuning fork

Probe to a distant galaxy

Video cassette recorders -now's the time to buy

GREAT HI-FI SECTION

*Two loudspeakers and Sansui stereo amp reviewed

*de-louse those hum bugs!

A new dynamic generation of Maxell tapes.

When Maxell announces an improvement in the quality of its tape, you can bet the improvement has to be pretty dynamic. In fact, we think our new generation has even gone beyond our own standards of superior sound reproduction.

Take our high level (CrO_2) position tape — the UD-XL II. Maxell engineers have succeeded in expanding its dynamic range in the middle-low frequency range by 1 dB, while also pushing its sensitivity by 1 dB in the high frequency range. Then look at our normal position UD-XL I, UD and LN tapes — our engineers expanded the dynamic range at all frequency points, while also boosting output in the high frequency range. The new dynamic range, of course, allows for better music reproduction even for LN-type tapes.

On the UD-XL I and II, we also added an exclusive shell stabilizer for significantly improved tape running and track positioning.

One thing hasn't changed on all Maxell tapes — our functional features like 4-function leader tape, replaceable index labels for UD-XL series tapes and Maxell's through-production system — your guarantee of quality and superior sound reproduction.

Tape selector position UD-XL I, UD, LN: Normal position (Normal bias/120 μsec. EQ)
UD-XL II: High level position (High level bias/70 μsec. EQ)

For details on all Maxell Recording Tape write to
Maxell Advisory Service, P.O. Box 307, North Ryde, N.S.W. 2113

Available time length UD-XL I: 60, 90 min./UD-XL II: 60, 90 min.
UD: 60, 90, 120 min./LN: 60, 90, 120 min.

Distributed by...
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maxell®
simply excellent

WT126/79

Registered for posting as a publication – Category B

eti ELECTRONICS TODAY INTERNATIONAL

THE FASCINATING THING about space exploration is – there's no limit ! Our space feature this month is a report on Project Daedalus, about a study on **sending an unmanned probe to a neighbouring star system.** Returning to Earth, if you've been musing about buying a **video cassette recorder** then you'd best take a quick read of our article (starts page 135) and get in quick because they won't remain at such low prices as at present !

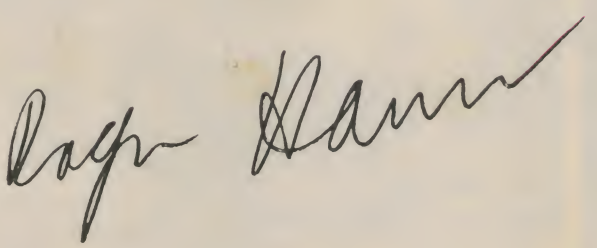
Got the flat note blues ? Tune up with our **Electronic Tuning Fork.** Crystal-derived accuracy and straightforward pc board construction are features and you can plug it into your guitar amp, too. For the hobby computer enthusiast, last month's news about the **Z-80 processor board** should have whetted the appetite. Well, here it is – page 30, right now.

On the hi-fi front, one wonders if amplifier technology could be improved much these days. Judging by the report on **Sansui's AU-417,** the answer seems – not much ! Two speaker reviews are featured in the Sound section this month, the **Model 15 from Altec-Lansing** and the **DR-1 from RTR.**

Lastly, we have some good news and some bad news . . . as the well-known joke goes. **December the 7th** will go down in history as **"The last, great, wild Synergistic Beer Drinking Fling".** All good things come to an end . . . see page 98. The bad news will be the following day . . . . .

So you think this issue's a good one ? Wait until you see December !

Roger Harrison, Editor



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eti ELECTRONICS TODAY INTERNATIONAL

COVER

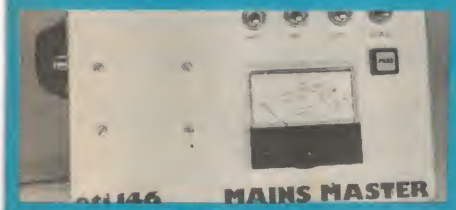
To highlight some of this month's features, Ivy Hansen has done a little graphics design with the camera. Two loudspeaker reviews are featured in the Sound section and our 'popular' project for this month is an Electronic Tuning Fork.

The speaker drive units are courtesy of Philips; at lower left is their latest dome mid-range driver AD02161/SQ8, upper right is the 300 mm bass driver AD12100.

news

features

projects



sound

general

next month

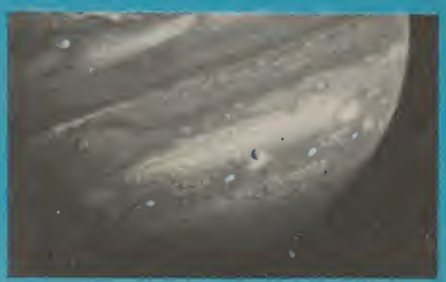
BUMPER PROJECT ISSUE !

We are planning to present many more projects in December than we usually do — with a special emphasis on **simple projects.** As summer is here, we also have a number of projects using silicon solar cells — practical and instructive.

Look at some of what we have lined up:

- Super-simple intercom
- Fog Horn
- Egg timer
- Two crystal sets
- Solar-powered radio
- Analogue audio frequency meter

If you're a constructor, don't miss the December issue !



JUPITER REVEALED

In our June issue Brian Dance reported on the Voyager 1 encounter with Jupiter and its moons. Now he tells about the Voyager 2 encounter with the Jovian system, discusses further the results obtained from these missions and reveals some startling pictures.

OSCILLOSCOPES

Being able to 'see' what goes on in a circuit is 90% of the battle of finding out how it works. Our feature is a practical guide to these fascinating and highly useful instruments, how they work, how to use them and what's around.

Although these articles are in an advanced state of preparation circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

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READER ENQUIRIES

By Mail: There is no charge for replies but a foolscap-size stamped addressed envelope **must** be enclosed. Queries relating to projects can **only** be answered if related to the item as published. We cannot advise on modifications to projects, other than errata or addenda, nor if a project has been modified or if components are otherwise than specified. We try to answer letters as soon as possible. Difficult questions may take time to answer.
By phone: We can only answer readers technical enquiries by telephone after 4 pm. In enquiring by telephone about back issues or photostats, please ask for the "Subscriptions Department". **33-4282**

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THE MARUNI HV3000R

N.B. MARUNI microphones take some beating too!!!

MARUNI

SUPERLATIVE HEADPHONES AND MICROPHONES

THE **MARUNI** CORPORATION

297 WILLIAMSTOWN ROAD, PORT MELBOURNE, 3207 • TELEPHONE, 645 2079 • TELEX 32571

COMPUTER CORNER

OWN A TRS-80? READ THIS AND SAVE!

The Dick Smith Mini Disk Drive is 40% cheaper than the Tandy Disk Drive, and has 14% larger capacity. See our advert on page 24 of September Electronics Australia for more exciting details!

$379.00 Cat X-3230

SCOOP PURCHASE

SAVE $20.00 ON TAPE READERS!

Be quick! Easy-to-build paper tape reader kit for all computer enthusiasts. Hurry! NOW **VALUE! $75.00!** Cat K-3466

UPGRADE YOUR TRS-80, APPLE OR SORCERER

So they've reduced the price of their 16k expansion kit. **It's still double the price of ours!** Upgrade your TRS-80, Apple or Sorcerer to 16k (or 32k from 16k) with our easy-to-fit expansion kit. Full instructions provided. Don't be conned into paying $300 for a $150 conversion! Cat X-1195 (TRS-80 conv. Cat X-1188)

(NB Extra switches required for both TRS-80 & Apple. See our store staff)

$149.50

TREASURE HUNTERS

Dick Smith Electronics has treasure hunters for all budgets – from simple types under $30.00 to the finest available: the mighty Fisher 555D – the 'Rolls Royce' of treasure hunters. Find the treasure hunter you went from our outstanding range:

Budget Model: Ideal for the beachcomber.
You won't need to find a gold mine to pay for this one! Self contained, uses single 9 volt battery. Fingertip adjustable controls. Cat X-1062 ..... **$29.50**

Techna Tracker TR Discriminator (the only detector with a microprocesser IC!) This unit fools the experts: it looks so simple, but it is a true T-R (transmit/receive) type with incredible sensitivity. Cat X-1065..... **$125.00**

(See our advert elsewhere in this issue).

D-tex Treasure Hunters: for when you're serious about treasure finding! Four versions of this world-famous detector:
(1) With single 200mm search coil ..... Cat X-1073 ..... **$395.00**
(2) With 200mm AND giant 355 search coils OF (3) with 200mmcoil and GROUND REJECTION circuitry instead of large coil .... Cat X-1074 (specify type) **$450.00**
(4) With both 200 & 355mm coils AND ground rejection .... Cat X-1075 .... **$480.00**

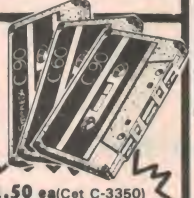
NOTE: a budget D-tex model with 200mm coil only is available in limited quantities only. D-tex model Coin King 1: ..... Cat X-1073 ..... **$395.00**

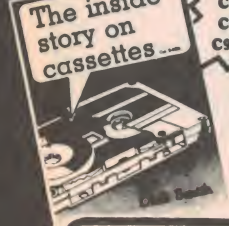
AND THE BEST OF THEM ALL:

THE FABULOUS FISHER 555D – a VLF (very low frequency) T/R discriminator with ground rejection – acknowledged by experts to be the state-of-the-art in treasure hunters. It sells for $100 less than its nearest rival, the Whites 6000D!
Fisher 555D (may be in limited supply for a few weeks) ... Cat X-1076 ... **$549.00**
NOTE: We strongly recommend that beginners in treasure hunting do not purchase the Fisher 555D. It is so incredibly sensitive it is quite difficult to use and master unless you have an expert to show you how!

NEW!

Dick Smith cassettes have been up-graded. Brilliant new packaging tells you they're different – find out for yourself just how good they really are! Try a couple of these quality tapes: better still, try ten (types can be mixed) to obtain the bonus book below!





C60 LN: $1.50 ea (Cat C-3350)
C90 LN: $2.00 ea (Cat C-3352)
C90 EDR: $2.75 ea (Cat C-3354)

BONUS:

Buy any ten 'Dick Smith' cassettes; or any Dick Smith cassette deck or recorder and receiver FREE a copy of our new book: 'The inside story on cassettes'. Tells you all about this incredibly versatile recording medium, and how to get the best from your tapes and tape recording equipment. Also available separately: Cat B-6035 @ 50c

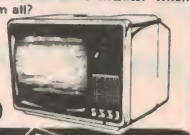
UNUSUAL GIFT IDEAS

Novelty radios make ideal gifts! One is disguised as a pig – male chauvinist model to be exact. The other a big screw: (around 300mm long, that's how big!) Incredible what these Orientals will get up to!
Big Screw: Cat A-4305 ..... was $59.50 NOW **$5.95**
Male chauvinist pig: Cat A-4310. Was $9.95; now only **$5.95**

SUPER SPECIAL: 2114 Memory IC's at almost half price. 4k static RAMs ideal for the experimenter were $14.30 NOW $7.30
Be quick for this bargain Cat Z 9306

LOW COST MONITOR

Suits Exidy Sorcerer, Tandy TRS-80, Apple, etc etc. Why pay over $200 for a monitor when this one suits them all?
Brand new & guaranteed
12V DC/240V AC operation
Cat X-1196



$149.50

MAIL ORDER SPECIAL

Incredible value! Quality EMI C-30 cassettes at a fraction of the price you'd expect. Ideal for letters, lectures, computer use, music, etc etc etc. And look at the price again!

(SORRY – This special is for mail order customers only. Personal shoppers: watch your store for in-store bargains.)

Cat C-3030 **75¢**

SUMMER TIME IS BARBIE TIME!

But it's also fire bar time. Don't let fire bans ruin your picnic plans. With a Solar Grill from Dick Smith you can have that outdoor barbecue anytime the sun is out – fire bans or not! This incredible space age cooker will do your steaks perfectly – also chops, snags, onions, tomatoes, etc etc. And you don't pay a cent for fuel! It will even boil the water to wash up! (A litre of water boils in approximately 9 minutes in sunlight!)

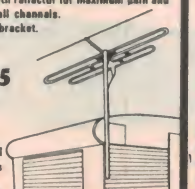
Cat X 2001

$95.00
(It might sound expensive but remember you never have to pay for fuel to use it!)

A go-anywhere TV antenna – for car, house, boat, etc etc.

You can mount this in vertical or horizontal mode for either polarity transmission – so it is ideal for use on a caravan. Double folded dipole with reflector for maximum gain and minimum ghosting on all channels. Comes with mounting bracket.
Cat L-4026

$23.95



BALUN:

Want to use co-ax? You'll need a balun. This one is weatherproof, strong.
Cat L-4452 **$2.50**

DON'T FORGET! XMAS IS NEXT MONTH

YOU ASKED FOR THEM

So we got them! You've asked us for 9 volt alkaline cells – here they are. Duracells: alkaline batteries which outlast carbon cells by up to 6 to 1. So for those projects which need long battery life: Cat S-3286

$2.50

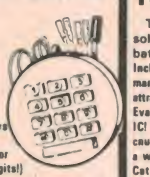
FIBRE OPTIC

Light your way in dark corners with this handy fibre-optic torch. Shaft bends & twists into the 'works'; great for the handyman & hobbyist.

Cat X-1085 **$3.95**

DEAR CUSTOMERS . . .
Quite often, products we advertise are completely sold out within a few days. Or problems may hold up delivery of promised goods so they are not in the stores when the advert appears. Please don't blame the store manager or staff: they are powerless to do anything about it! What we are trying to say is that, if you are about to drive across town to pick up a particular line, give the store a ring first . . . just in case!
Dick Smith and Staff

THEY'RE BACK (we hope)!



Ideal hobby use
For private & experimenters phone systems
Dial quicker – remembers last number dialled!
(Simply push 1 button for auto re-dial up to 18 digits!)

The response has been overwhelming! Two shipments have sold out – hundreds have been disappointed. Now another shipment has arrived of these remarkable push-button phone diallers which remember the last number you dialled. If you want one, hurry: stocks won't last long!

ATTENTION: Although these diallers fit perfectly into standard Australian telephones (no soldering required) present regulations do not allow you to use them for this purpose.

$49.95 Cat X-1175

LCD CLOCK MODULE

Scoop purchase! Time & date modules, ideal for phone timers. Liquid xtal disp., buy direct from the importer and save. Battery included!
Cat X-1039

***Incredible accuracy Incredible value* $12.50**

IT'S ABOUT TIME . . .

STOPWATCH/TORCH

Incredible! A stopwatch that can do splits, lap timing, etc down to 1/100 second, in a tiny case that also includes a torch! LCD readout for long battery life, highly accurate.

Note: due to demand stocks may be low until mid month!
Cat X-1043

$39.50

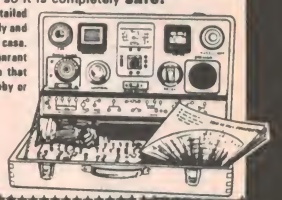
PS. It's a clock, too!

VALUE FOR THE MOTORIST:

Quartz chronometer accuracy; large, easy-to-read fluorescent digits. Operates from 12 volts, takes less power than your dash lights. Easy to instal, bracket supplied.
As shown, with case: Cat X-1047
$24.50
Unit without case (for installation in dash): Cat X-1045 **$19.50**

150 PROJECTS TO BUILD. . .

That's right, a whole 150 of them. Radios, amplifiers, solar projects, etc etc. No soldering required, and it is battery operated – so it is completely **safe!**
Includes beautifully detailed manual; housed in sturdy and attractive wooden carry case. Even includes a transparent IC! An ideal gift – one that could start a useful hobby or a worthwhile career.
Cat K-2030

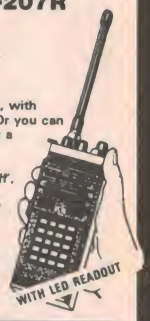


$53.50

COMING SOON!

The new Yaesu FT-207R CPU controlled, synthesised 2m hand-held

800 channels across 144–148MHz, with keyboard entry of all frequencies! Or you can scan manually, or automatically for a busy or a clear channel. With four channels of frequency memory; memory back-up when power is 'off'. 600kHz repeater splits (or odd splits if you wish) – it's got the lot! Don't buy a 2 metre rig until you see this superb technological breakthrough. It's due in our stores in just a few weeks – and it will be well worth the wait!
Cat D-2888 **$358.00**



AMATEURS

DON'T FORGET Dick Smith will match or better ANY GENUINE ADVERTISED PRICE on Yaesu or Hy Gain amateur equipment!

EXCLUSIVE TO DICK SMITH!

"GOLDEN ROD" TV ANTENNA

Cat L-4022
$29.50

If you live in the metropolitain area or even a fringe area, then this is the antenna for you. It will give excellent results. Maximum gain on channels 0,2,7,9 & 10, with GOLD ANODISED elements for extra long life. 300 ohms impedance; complete with mounting bracket.

RECTANGULAR LEDS!

Give your projects that real pro look with these smart rectangular leds. Available in red or green.
RED Cat Z 4040 GREEN Cat Z 4042
65¢ each
(55¢ each for 10 or more)

AT LAST! Wollongong Now Open

The new Dick Smith Wollongong store is now open. Call in and say hi to the manager, Peter Herding, and his friendly staff. For everything you went in electronics, – 263 Keira Street, Wollongong. Phone 28 3800

HUGE STOCKS NOW IN!

The WIA Amateur Radio Callbook (1979 EDITION) **$2.95**

Yes! We now have large stocks of the all new, up-dated 1979 edition of the Wireless Institute's Australian Amateur Radio Callbook. Contains the callsigns, names and addresses of almost all the amateur operators and SWLs in Australia & PNG, plus loads of data & information. Every amateur & SWL should have a copy. Cat B-2317

BUYING BY MAIL?

It's so easy! Simply list the items you want, with their catalogue numbers, and post it off with your cheque to our mail order centre (address at right) Don't forget to include post & packing (charges apply to total order value as per table at right) Then watch your letterbox!

ORDER VALUE:	P&P
$5 (min. to $9.99	$1.00
$10.00 to $24.99	$2.00
$25.00 to $49.99	$3.00
$50.00 to $99.99	$4.00
$100 or more	$5.50

NOTE These charges apply to goods sent by post in Australia only. Large and bulky items cannot be sent by post
If you prefer, we will despatch your order by Comet Road Freight to anywhere in Australia for only $6.00 – that's below what it costs us! Large and bulky items are normally sent by Comet unless you specify differently (eg by rail or air – you pay freight on delivery)

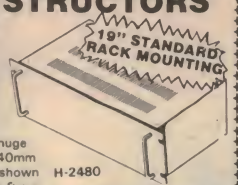
MINI HI-FI SPEAKERS

Top performance from such a tiny speaker. If space is a problem, or if you don't want your speakers to look obtrusive, try these. They're only 120 x 120 x 190mm, and performance is equal to many speakers costing two and three times as much! Try them: you'll be pleasantly surprised! Cat A-2375

- Car
- Boat
- Caravan
- Home Units & Flats

$99.50 pair

CALLING BIG CONSTRUCTORS



The answer to space problems: This huge rack mounting case. Quality construction, measures a huge 425x250x140mm Comes as shown with handles & pre-punched ventilation holes. Professional quality. H-2480

$49.50

COMING SOON: DICK SMITH'S 'FUN WAY INTO ELECTRONICS'

The all-new introduction to electronics. At a Dick Smith store or bookseller SOON!

OMRON DPDT PCB RELAY ONLY $3.50

Cat. S-7135

Just look at this superb relay bargain: rated at 12V DC with 290 ohm coil resistance; massive 0.4A contact rating. Mounts direct on PCB, ideal for modern circuits requiring a small relay.

IN A WORD: BRILLIANT!

3-way light: fluoro, spot and flashar for campers, in the car, home; wherever you need a portable lamp. Hand held or use shoulder strap supplied. Cat X-1084

$14.95

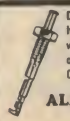
IT'S THE TIME OF THE BURGLAR AGAIN — AND IT'S TIME YOU DID SOMETHING ABOUT THEM!

GLASS BREAKAGE DETECTOR

Incredible! Up-to-the-minute technology gives protection for shops, offices, homes, etc. Simply glues on window; if glass breeks, it actuates alerm system. Is not effected by tapping or other sounds; sensor reacts only to sound of glass actually breaking. Approx. 25mm cube.

Cat L-5230

$29.50



Door switches: handy for car alarms, home alarms, etc. normally open with door closed, close when door opens (if that's not double dutch . .) Cat L-5256. . . . . **$1.65 pr.**

ALARM COMPONENTS

SIREN SPEAKER: Highly efficient deters the most determined felon. Operates from 12 volts. Cat L-7026 . . . . . **$22.50**

FERRIC CHLORIDE IS NOW IN EASY–MIX PACK . . .

Yes! No more mucking about with powders, waiting for them to dissolve. Now Dick has handy packs of ferric chloride in concentrated liquid form: just pour into water and you have instant solution. Makes 600ml of etchant. Cat H-5652

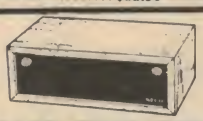
20% MORE ETCHANT FOR THE SAME PRICE!

$1.90

FULLY INTEGRATED RELIABLE CAR PROTECTION

At last: a reliable auto alerm that is easy to use. Installs in minutes, senses voltage drops in system to sound alerm. Even has a special loop for CB & cassette, etc, protection. 12 volt, suits all negative earth cers. Does not use vehicle horn: built-in siren for top protection.

$49.50 L-5090



GUARD YOUR HOME!

A lot of burglaries occur when you are at home! Guard your house with this portable ultrasonic alerm. If anyone crosses the invisible beam, the alerm sounds. Ideal for when you're watching TV, leaving the rest of the house unguarded. Battery operated, mains operation via optional power pack. Covers up to 300 square feet. Outstanding value; cheap insurance!

Cat L-5108 **$99.00**

VALUE!

For computer enthusiasts, experimenters: This calaculator keyboard kit with a host of uses: comes complete with screws, PC board, all keys and spring pad. Ideal for combination locks, alarm systems, tea. Cat K-2010

$3.75

Pack of four momentary push button switches Four different colours available. Great value Cat S-1200 **$2.50**

BONZA BULK BUY BARGAINS – BEWDY!

BIG QUANTITIES Interested in buying (or selling) big quantities of 'bonza bulk buy' lines such as we show here? Talk to our marketing manager . . Phone (02) 888 3200

Budget Car Sound

A speaker for $2.50? Who's kidding?? Certainly not us. These incredible value car radio/stereo speakers are 16 ohm impedance (so they'll suit anything!) and measure 100 x 150mm. Cat A-7132

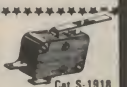
$2.50!!!

Slider pots take a tumble . . .

Top quality slider pots, made by Sonar. 50k resistance, probably the most used value going. Compare our price with others! Cat R-1982

60¢ ea!

TOP VALUE! SPST MICROSWITCH FOR JUST 60¢!



Cat S-1918

Yes, that's right . . . a microswitch for only 60 cents! These brand new, handy little switches were bought as a bulk purchase – and the huge saving is passed on to you. Micro switches normally sell for around $2 – $3 or so! Think of the uses: alarms, control circuits, models, service work, etc etc. Save now!

SAVE 20% FANTASTIC SAVING.... WAY UNDER RECOMMENDED RETAIL PRICE!

Famous 'Weller' cordless soldering iron

INCLUDES MAINS CHARGER AND TIP • 12 MONTH GUARANTEE RANGE OF SPARE TIPS IN STOCK !

For soldering power wherever you go: this handy Weller iron has inbuilt re-chargeable cells; comes with mains charger. Bulb in end lights the way in dark corners. Incadible value: compare our price

$26.00 Cat T-1050 **$32.50** value!

IC SOCKETS LEAP DOWN IN PRICE!

Save with Dick Smith bulk buying power: we've slashed the price of our most popular IC sockets by up to 25%! Don't miss out . . . 8 pin mini dip: Cat P-4080 was 40c each Save 25% – **NOW ONLY 30¢ ea!** 14 pin DIL Cat P-4140. Were selling for 40c. **NOW ONLY 35¢ EACH!**

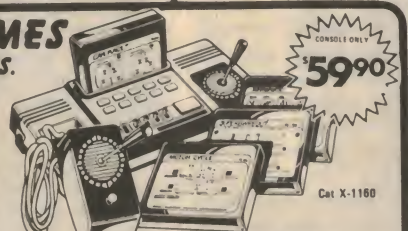
FABULOUS COLOUR TV GAMES

GREAT FUN FOR CHILDREN AND ADULTS.

Great for when the TV programs are crook (and isn't that a lot of the time?). These **colour** TV games feature plug-in cartridges which give you greater choice: you simply buy the cartridges you want. Simple to operate, will not damage the TV set in any way, hours of fun and enjoyment for the whole family. Price includes basic 6 game program.

OTHER CARTRIDGES AVAILABLE:

10 game super sports (Cat X-1162)	$20.00
Motorcycle – four games of skill (Cat X-1163)	$29.00
Car race – play a friend or the clock (Cat X-1165)	$25.00
Wipeout – Six fascinating games (Cat X-1168)	$25.00



CONSOLE ONLY **$59.90** Cat X-1160

Other TV games available from a low $19.95!!!

NEW KITS (and new kit components)

Remember: parts for most kits in most of the electronic magazines are normal stock lines. So even if a kit isn't listed, we may be able to help you anyway. Call in and ask us!

PROCESS TIMER (see ETI OCT '79)

Printed circuit board	Cat H-8623	$3.95

INFRA-RED REMOTE CONTROLLER (See Oct. EA)

CQY89A Infra-red diodes	Cat Z-3235	$1.50
BPW34 Photo transistors	Cat Z-1954	$3.50
Printed circuit boards (pair)	Cat H-8365	$6.95

DISCO STROBE (similer to ETI September)

Complete kit	Cat K-3150	$29.50
Printed Circuit Board	Cat H-8572	$1.95
Fleshtube	Cat S-3882	$2.95
Trigger transformer	Cat M-0104	90c
Discherge Capacitors (each)	Cat R-2855	$3.75
Reflector	Cat K-6016	$4.50

WINDSCREEN WIPER DELAY (See September EA)

Printed circuit board	Cat H-8364	$2.50
Other components for this project are normal stock lines		

AUTO CHIME (See September EA)

Complete kit	Cat K 3502	$29.75
Printed Circuit Board	Cat H-8363	$3.70
TMS-1000 Integrated Circuit	Cat Z-6825	$16.50

INDUCTION BALANCE METAL DETECTOR (See ETI)

Short form kit (not including former or dowell for rod	Cat K-3100	$35.50
Printed circuit board only	Cat H-8578	$1.50

PLAYMASTER STEREO EQUALIZER (See May EA)

Complete kit including instructions	Cat K-3500	$99.50
UA4136 Quad Op Amps	Cat Z-6105	$1.88
PC Boards (set of 3 high quality boards)	Cat H-8360	$12.95
Slider pots	Cat R-1980	85c
Knobs to suit slider pots	Cat H-3782	50c

9kHz WHISTLE FILTER FOR TUNER (See Feb EA)

Complete kit, including instructions	Cat K-3496	$19.75

INTERSIL LCD EVALUATION KIT (See Feb EA)

(As used in EA digital voltmeter)	Cat K-3450	$39.50

MAJOR DICK SMITH RESELLERS

Listed below are re-sellers who stock a large range of our products. However, we cannot guarantee that they will have all items in stock or at the prices we advertise.

A&M Electronics
78 High Street, Wodonga, Vic. Ph 244 588
Advanced Electronics
5a The Quadrant, Launceston Tas. Ph 317 075
Aero Electronics,
123a Bathurst Street, Hobart Tas. Ph 348 232
Peter Brown Electronics
9 Doveton Street North, Ballarat Vic. Ph 323 035
Coastal Electronics
43 Vulcan Street, Moruya NSW. Ph 742 545
Crystal TV Rentals Pty Ltd
66 Crystal Street, Broken Hill NSW . Ph 6897
Delta Electrix
67 Queen Street, Ayr, Nth Qld. Ph 831 357
Elektron 2000
44 Brown Road, Broadmeadow, Newcastle NSW. Ph 691 222
Fred R Hayes Electrical
28 Station Street, Bowral NSW. Ph 611 861
D & M Harrington,
6/1 Machinery Drive, Tweed Heads South, NSW. Ph 364 589
Hutchesson's Communications
5 Elizabeth Street, Mt Gambier SA. Ph 256 404
Keller Electronics
218 Adelaide Street, Maryborough, Qld. Ph 214 559
Lismore Kitronics
Cnr Magellan St & Bruxner Hwy, Lismore NSW. Ph 214 137
M&W Electronics
48 McNamara Street, Orange NSW. Ph 626 491
Mellor Enterprises
Shop 2/15 Forsythe St, Whyalla Norrie, SA. Ph 454 131
Power & Sound
147 Argyle Street, Traralgon, Vic. Ph 743 638
Stevens Electrical
42 Victoria Street, Mackay, Qld. Ph 511 723
Sumner Electronics
95 Mitchell Street, Bendigo, Vic. Ph 431 977
Sound Components
78 Brisbane Street, Tamworth NSW. Ph 661 363
Trilogy Wholesale Electronics
40 Princes Hwy, Fairy Meadow, Wollongong, NSW. Ph 831 219
Tropical TV Services
249 Fulham Rd, Vincent, Townsville Qld. Ph 791 421
Variety Discounts
113 Horton Street, Port Macquarie NSW. Ph 835 486
Wellington Electrical Services
110 Lee Street, Wellington NSW. Ph 325

DSE642

DICK SMITH ELECTRONICS

NSW	125 York Street,	SYDNEY	Ph 290 3377	VIC	399 Lonsdale St, MELBOURNE. Ph 67 9834
	147 Hume Hwy,	CHULLORA.	Ph 642 8922		656 Bridge Road, RICHMOND. Ph 428 1614
	162 Pacific Hwy,	GORE HILL.	Ph 439 5311	QLD	166 Logan Road, BURANDA. Ph 391 6233
	30 Grose Street,	PARRAMATTA.	Ph 683 1133	SA	203 Wright St, ADELAIDE. Ph 212 1962
	263 Keira Street,	WOLLONGONG.	Ph 28 3800	WA	414 William St, PERTH. Ph 328 6944
ACT	96 Gladstone St,	FYSHWICK.	Ph 80 4944		

EXCEPT WHERE NOTED, ALL ITEMS SHOWN IN STOCK AT PRICES GIVEN AT TIME OF GOING TO PRESS.

MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113. Ph 888 3200. PACK & POST EXTRA.

bankcard welcome here

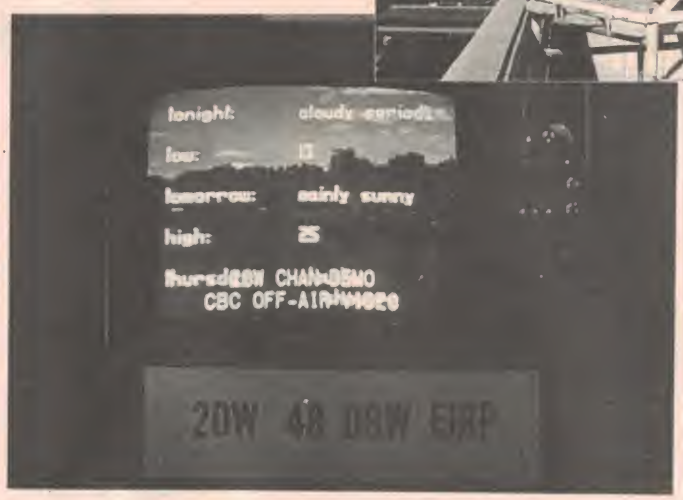
SHOPS OPEN 9AM to 5.30PM (Saturday: 9am till 12 noon) BRISBANE: Half hour earlier. ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY

RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS OF AUSTRALIA.

NEWS digest

Satellite TV broadcasting trials in Australia a success!

The Canadian Department of Communications demonstrated direct-to-home TV satellite broadcasting in Australia, in co-operation with the Australian Post and Telecommunications Department, during August and September.



ABOVE: The 1.2 m diameter dish of the TV Receive Only (TVRO) demonstration terminal installed at the University of New South Wales campus for the IREECON in August. Downlink is on 12 GHz.

LEFT: Picture originated in Canada and received in Australia via the Hermes experimental domestic broadcasting/telephony satellite. This is an example of low power reception from the satellite's 20 W transponder.

The Hermes experimental satellite was employed for the trials, which used a number of low cost TV receive-only (TVRO) earth station terminals. Telephony demonstrations were also included in the trials.

The Hermes satellite was moved from its location above the equator south of Calgary (Canada) to 142 degrees west longitude, over the middle of the Pacific, for the demonstrations, where it could be 'seen' from eastern Australia.

A workshop — "Satellite Communications — Canadian Experience and Australian Planning" — was held in Canberra over 22-24 August at which both TV and telephony satellite communications were demonstrated.

The Canadian team conducting the trials here demonstrated a telephony hookup via the Hermes craft using two terminals employing one metre dishes operating on the experimental 12/14 GHz band. The terminals were connected to the Australian switched telephone network and ISD dialling via the satellite was demonstrated.

The recent IREE convention (IREECON) in Sydney was treated to satellite TV demonstrations via Hermes, from 27-31 August. From the 4th to the 21st of August demonstrations of TVRO terminals were carried out at about 50 different remote rural locations in eastern Australia, through NSW and QLD. These demonstrations were quite successful and were met with a great deal of interest.

The team demonstrated low and high power TV reception from the satellite using 1.2 metre diameter (!) dish antennas, electronic equipment suitable for domestic production and standard consumer TV sets.

Further successful demonstrations of telephony and TV were conducted in New Guinea on September 4 and 5.

Dr John Chapman, Assistant Deputy Minister (Space Programme) in the Canadian Department of Communications, (DOC) led the Canadian delegation to Australia, which comprised representatives from the DOC, the Canadian Telecommunications Carriers Association, Telesat Canada, Spar Aerospace Ltd of Montreal, SED Systems Inc of Saskatoon and the Ontario Educational Communications Authority.

Unfortunately, Dr John Chapman — known as 'Mr Satellite' — died shortly after returning to Canada.

Hermes is the eighth of nine Canadian satellites in orbit. Launched in January 1976, it had a design lifetime of two years, but was in its fourth year of operation. The Canadian designed and built satellite has been used in a wide range of social and technological experiments in areas such as teleeducation, telehealth, community interaction and broadcasting to remote communities. Hermes was the first satellite to operate in the 14/12 GHz frequency band. Its high power permits direct broadcasting to receiving dishes as small as 600 mm in diameter. Such earth stations are expected to be mass produced and cost as little as $500 in the near future. Hermes was shutdown in September.

Sinclair split

Britain's Sinclair Radionics Ltd is to be split up following a decision by its principal shareholder (Britain's National Enterprise Board).

The company is currently best known for its $200 50 mm screen pocket TV set — the rights to which have been sold to Binatone Ltd in Wembley, Middx.

It is possible that the UK Philips' subsidiary, Mullard Ltd, may produce Sinclair's thin-screen TV. Development of the latter unit will be continued by founder-director Clive Sinclair through his wholly-owned company, Sinclair Research Ltd.

Training in electronics and communications

Newcastle Technical College provides a wide range of electronics training courses for residents of Newcastle and the Hunter Valley and offers the Electronics Trades Course both as a fulltime pre-apprenticeship course, and in block release pattern to provide for apprentices and others throughout Northern NSW.

The Electronics Trades Course which replaces the older Radio Trades Course has been broadened to include both analogue and digital techniques and offers a range of optional subjects in stage 3 in specialised areas of the industry.

Other courses offered include Post Trades Television, Radio Transmission, Industrial Electronics, Basic Electronics, Two Way Radio Users Course, Technical Principles of Two Way Radio, and Television Studio Techniques.

Thus, the College caters for a wide range of interests from hobby and amateur radio, through trade courses to post trade courses.

Other special courses may be made available subject to sufficient demand.

Enquiries regarding enrolments, content of courses, attendance patterns, entry requirements can be made in writing to —

The Senior Head Teacher
School of Applied Electricity — Electronics Division
NEWCASTLE TECHNICAL COLLEGE
Maitland Road,
TIGHES HILL. NSW. 2297
or by phoning (049) 61-0461 extn 367.

Get the FAX ma'am

Melbournians can now send or receive facsimile copies of documents to a number of overseas cities.

Whilst services such as these have long been used by newspapers this is the first time in Australia that such a facility has been available to the public.

Overseas-Fax, the name given to the new service, opened for business in OTC's Melbourne office on September 1, 1979. It supplements the international phototelegram service which has been operating for a number of years.

Overseas-Fax is available 24 hours a day, seven days a week, so that documents can be transmitted during local business hours or to coincide with those in overseas destinations. Incoming facsimile copy can be collected from OTC's office or delivery arranged by mail or courier.

The unique feature of Overseas-Fax is its ability to transmit and receive all types of documents (line drawings, manuscripts, plans and graphs, magazine layouts, clothing designs, ideographic scripts, customs documents, edited copy and signatures) in faithful reproduction over any distance, bureau-to-bureau, within minutes. Colour cannot be reproduced and satisfactory black-on-white reproduction of coloured documents depends largely on their contrast.

Overseas-Fax presently corresponds with RCA Global Communications offices in New York, San Francisco, Hawaii and Washington DC. Extensions of the service to Hong Kong, Manila and Singapore will follow shortly. Other major overseas centres will have the service soon.

At a cost of $10 per A4 page, Overseas-Fax compares favourably with courier or airfreight charges, but its major advantage is time-saving. Usually, the document can be collected at the corresponding overseas bureau within an hour of transmission from Australia. These bureaux also offer a number of delivery options including mail and courier services. It is also possible to forward the document from the receiving bureau by facsimile retransmission.

Though the Overseas-Fax service is initially only available in Melbourne, a bureau is intended to be soon established in OTC's Sydney head office.

All enquiries concerning Overseas-Fax should be directed to (03)60 0351 (Melbourne) or (02) 230 5284 (Sydney).

ELECTRONICS AUSTRALIA EDITOR JOINS DICK SMITH

MR. JAMIESON ROWE has been appointed Technical Director of the Dick Smith Electronics group of companies. He takes up this position after almost 20 years with Electronics Australia magazine, having held the position of Editor since March, 1971.

A graduate in both Electronics Engineering and Arts, "Jim" Rowe is well known in the electronics industry, in technical education and to Australia's electronics hobbyists. He has written many hundreds of articles and a number of basic textbooks. He is also regarded by many as the "father" of hobby computing in Australia, having designed from scratch one of the first hobby/teaching computers in the world.

"We see the 1980s as a period of incredible growth, both for electronics as a whole and for small computers in particular. I know that Jim Rowe has the skills and experience to enable us to take advantage of the opportunities represented by this growth."

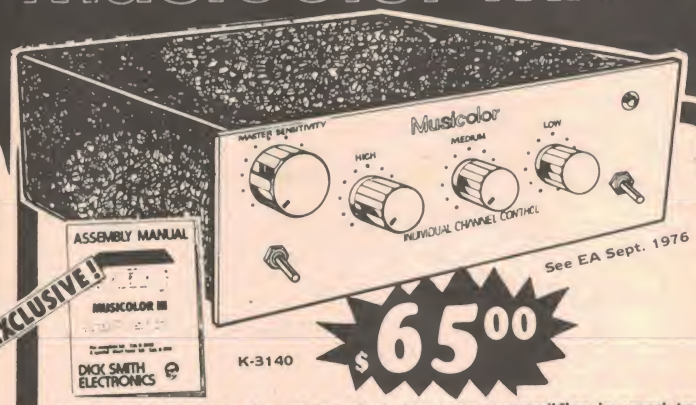
Jim Rowe is married, and he and his wife Laraine have three children. He is expected to take up his new position on November 5th, 1979.

"I am quite excited at the prospect of having Jim Rowe working with us", says Dick Smith.

DISCO

Yes! Your next party can be just as exciting, vibrant and colourful as the best disco . . . splashes of colour and light to make any party really swing!
Dick Smith has some fantastic disco gear and it won't cost you big money either. . . .

Musicolor Mk III



EXCLUSIVE!

See EA Sept. 1976

K-3140 **$65.00**

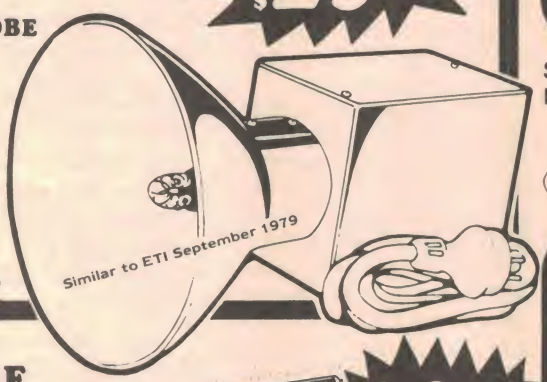
Music into light! Audio information from your amplifier is used to control 3 channels of coloured lights - as the frequency changes the lights beat to the music using different levels of sound to give different light levels. Easy to construct by using the exclusive 16 page assembly manual. (For coloured lights see below).

STROBE

Turn out the lights, switch on your strobe light and 'freeze' the action - turns your party into a light show of distinction. Everything in this kit has been made to make its construction easy - even for the beginner. Kit includes photographic type reflector with perspex safety screen plus all electronic parts and case, to make a superb strobe with a variable flash rate of 1 to 20 seconds. Easy to follow but comprehensive instructions are included with each kit.

'FREEZE' THE ACTION WITH A STROBE

$29.50



K-3150

See DPS for all P&P details

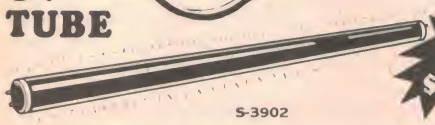
DISCO COLOURED LIGHTS

The Holder: wall, floor or ceiling mount with swivelling base so you can 'place' your light.
P-5620 $3.50 each

THE FLOODS: Screw into the above holder for use with Musicolor system

YELLOW	RED	BLUE	GREEN	ONLY
S-3850	S-3852	S-3854	S-3856	$7.95 each

UV TUBE



S-3902

$29.95

Not just a 'blued' tube - this is a true UV tube that will give fantastic effects when the normal room lighting is turned off. Clothes washed in certain brands of detergent will 'fluoresce' under this light to give weird and wonderful effects. The tube is rated at a standard 40 watts and has the normal two pin fitting.

The Complete DISCO light system

A completely integrated unit with 30 lights in 5 different colours covering frequencies from very low to ultra high. Connect to your HI Fi, plug into the AC, play your music and see the light show come to life! Presented in a wooden cabinet with multi-dimensional diamond pattern front for a colour show in depth. Size: 460(h)x290(w)x185(d)mm.

$79.00

A-4950

Also available and handy for disco installations:

AC mains plugs Cat. P-5400 only 55c each; 3 core mains cable Cat. W-2055 @ 40c/m or if you buy a 100 metres or more pay only 35c/m; Heavy duty speaker cable Cat. W-2012 @ 18c/m or for 100 metres or more pay only 15c/m; Cordless soldering iron (has in-built rechargeable battery) complete with tip and charger for only $26.00 Cat. T-1050 - plus many other 'bits and pieces' for your disco installation - Dick Smith Electronics the name behind successful consumer electronics. . . . .

DICK SMITH ELECTRONICS

SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS

Sinclair instruments feature versatility, small size

British manufacturer, Sinclair, have established a reputation for delivering versatile products in small packages for a reasonable price.

This being so, many technicians and hobbyists should be interested in two Sinclair test instruments featuring small size and versatile functions.

The PFM200 is an 8-digit, 200 MHz **hand-held** digital frequency meter. It has two ranges — 20 Hz to 10 MHz and 5 MHz to 200 MHz, with three selectable gate times to suit each range (six in all). It operates from a standard No. 216 9 V battery and comes complete with input leads for around $140. Not bad!

We had occasion to look one over in the ETI labs recently and it certainly did its stuff in fine style. The display is pocket calculator-sized, but so is the instrument! No doubt it would prove very handy for field-servicing applications.

We had the opportunity to play with the Sinclair DM450 digital multimeter also. This includes pretty-well the standard volts- (milli)amps-ohms and ac/dc ranges as found on many a multimeter. The instrument is battery-operated (four NiCad 'C' cells) and has a 6-digit display. Maximum current range is 10 amps, max. volts — 1200 dc, 750 ac. The ohms range starts at 200 ohms and goes to 20M.

It's a small device, housed in a plastic case that appears as if it would not stand much abuse — although we didn't really check this out.

Price is a competitive $256.52. Extras available are a high voltage ac prove, ac adaptor/charger and deluxe carrying case.

All worth careful scrutiny. Further details from Emona Enterprises Pty Ltd, Suite 8, 661 George St, Sydney 2000. (02) 212-4815.

Instant french letters

A nation-wide electronic mail system based on cheap and simple domestic facsimile machines is currently being researched by France's Postal and Telecommunications Dept.

The facsimile machines are being developed by Thompson CSF using 1728-element charge-coupled devices for document reading. A thermal device is used for printing.

The aim of the PTT is to have the new service in operation by 1981 — they hope for a million users by 1985.

Proposed cost of the terminals is around $400.

Presumably any alternative is better than France's existing internal mail services which by comparison make our own Post Office seem like the ultimate model of efficiency.

International award to Australian instrument

An Australian mineral survey instrument has won a prestigious international award.

The instrument, SIROTEM, which was invented by CSIRO and developed by Geoex Pty Ltd of Adelaide has been named as one of the winners of the IR 100 awards for achievements in science and technology.

The awards, for the most significant new technical products each year, are made by the international magazine Industrial Research and Development.

To win one of the IR 100 awards, SIROTEM faced international competition from organisations such as NASA, Massachusetts Institute of Technology, GEC, EMI, DuPont and Hitachi.

SIROTEM can be carried on a back pack and includes a control box containing a powerful electronic computer and a flexible loop of wire up to 400 metres long.

The instrument operates on the principle that ore bodies conduct electricity and is used by geophysicists to locate ore bodies before test drilling.

The instrument was launched into the commercial market early last year and already models — at about $20,000 each — have been sold in Finland, Sweden, the UK and Canada as well as within Australia.

World's longest opto-link

An experimental optical telecommunications system, 96 km in length, has been assembled by Philips Research Laboratories in Holland. It is believed to be the longest made so far.

The glass fibre connection takes the form of 16 reels of cable, each cable being made of six separate strands. The reels are connected in two sections of eight kilometres each.

The signal is passed down one strand in the cable, through a repeater at each eight kilometre section, through the second eight kilometre section — then through a further repeater before returning up the cable via a second strand. This sequence is repeated, via all six strands and eleven repeaters until the signal emerges at the end of its 96 km journey.

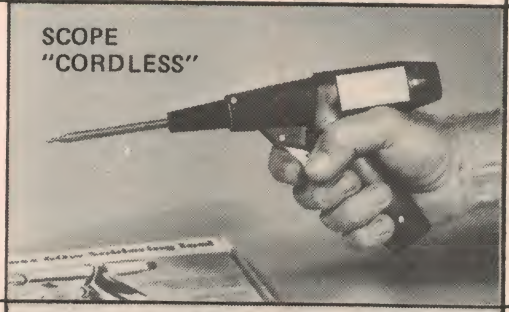
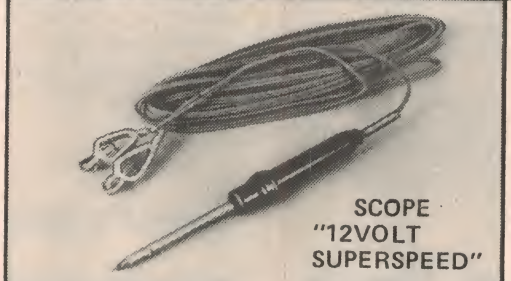
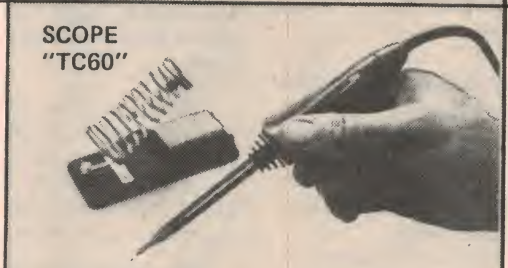
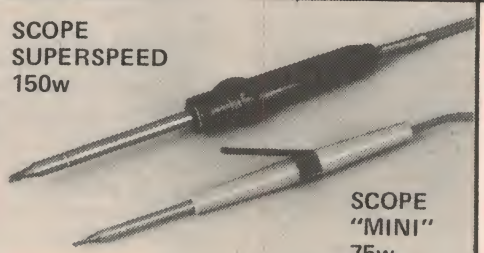
The attenuation of the system is a mere 4 dB/km including the joints every kilometre, hence the need for repeaters at only eight kilometre intervals — a big improvement over conventional copper cable links (which require repeaters every two to four kilometres).

Also in the opto-link field is the news from Japan's Nippon Telegraph and Telephone Corporation that they have succeeded in transmitting an 800 Mbit/s signal through a 30 km length of fibre-optic cable with an error rate of less than 10^{-12}. The signal source was a 1.3 um indium-gallium-arsenide — phosphide laser operating at room temperature. The attenuation at this wavelength is such that the loss in the cable is only 0.73 db/km including losses in splices every 2 km.

Total dispersion at this wavelength is almost zero thus making possible an extremely wide bandwidth.

SERVICE TECHNICIANS!

Specialised Soldering Tools from... SCOPE

SERVICE SITUATION	TAKE THIS TOOL	GET THIS USER ADVANTAGE
• No power • No time to get power • Must work on live gear	SCOPE "CORDLESS" 	1. 40–200 Terminations depending on conductor size. 2. Recharges overnight. 3. Heats in 6 seconds. 4. 60 watts – Controllable temperature.
• 12 volt. Battery power available only. • Outdoor and bad weather expected. • Service vehicle can get within 6 metres.	 SCOPE "12VOLT SUPERSPEED"	1. 5 Second heating. 2. 200 watts if needed. 3. Controllable temperature. 4. You can replace tip or element anywhere in minutes.
• Modern sophisticated PCB equipment. • Accurate & automatic temp. control wanted. • Components are heat critical.	SCOPE "TC60" 	1. Heats in 45 seconds. 2. Dial any temp. 200°–400° 3. Plugs direct to mains. No transformer needed. 4. Accept iron plated tips from 0.8mm to 6.4mm.
• Unpredictable soldering situation. • Maybe electrical or electronic or mechanical. • You can't come back to base for a bigger or smaller iron.	SCOPE SUPERSPEED 150w  SCOPE "MINI" 75w	1. 5 second heat up. 2. Controllable temperature. 3. Reserve heat for any normal job. 4. 4 volt safety in the hand.

Available from your normal trade suppliers in Australia and New Zealand.

SCOPE LABORATORIES
Box 63 Niddrie Vic., 3042.
Phone: (03) 338 1566. TLX 34382.

LETTERS

Dear Sir

Would it be possible for you to explain how to work out your capacitor values. I used to read ETI a while ago and noticed when I recently purchased a copy that the capacitor values have suddenly changed.

If you could show me how to convert from microfards to this new system I would be most grateful.

Yours faithfully
Shane Waye

Dear Mr Waye

Articles on component numbering and marking systems can be found in the May/June 1976 and March 1977 issues of ETI. Simply explained however, the system we now use is in common use and according to the system set down by the Australian Standards Association.

For capacitors, the terms pF, nF and uF are used. The lower case letters designating the capacitance "multiplier" relative to one Farad, as follows:

$p = 10^{-12}$ (pico)
$n = 10^{-9}$ (nano)
$u = 10^{-6}$ (micro)

Thus,
1000pF = 1nF, expressed as 1n
1000n = 1uF, expressed as 1u

Values in each multiplier range up to 1000 are expressed directly; for 1000 and above the next range is used. For example: 560p, 820p, 1n.

No decimal points are used, the multiplier letter replacing it, as follows:

5.6 pF is written 5p6
0.001 uF = 1000 pF, expressed as 1n
0.0056uF=5600pF,expressed as 5n6
0.01 uF is expressed as 10n

Similarly, with resistors. The multipliers used are:

R = 1; ohms, directly
k = 1000 (10^3); kilohms
M = 10^6; megohms

Thus, 560 ohms is expressed as 560R, etc. Again, no decimal points are used.

1800 ohms is written 1k8
0.56 ohms is written OR56
4.7 ohms is written 4R7

I trust this is of assistance.

Dear Sir

May I congratulate you and your staff on your fine publication. You have always catered well for our electronic interests and preoccupation. You have catered for those who combine other interests with electronics, e.g. Photography, Model Railway, cars, etc. How delighted, we who play around in boats would be, if we could combine more electronics with our boating.

Seriously, a group of us who share a common interest in electronics first and boating second, would be pleased to see some detailed technical articles on sonar with perhaps some circuits and construction projects on depth finders or indicators. What an exciting array of displays and alarms we could develop from this.

Looking forward to many more years of reading ETI.

Brian Clark
Windsor, NSW

Dear Roger

Congratulations on a most improved format! The magazine is most sophisticated now but still caters for all levels of readership.

Never overlook the teachers and kids for their basic theory needs and simple practical models.

I've a few ideas: what about an article discussing the various decibel designations - i.e. dBm (0 dBm, +4 dBm, +8 dBm - who uses what and why; dBV, dBi, dBmV, etc. Also what is the 'NAB' and the 'IEC' and what are they all about?

Your October article on the toxicity of Berryllium was very timely.

Graeme Scott VK3ZR
Surrey Hills, Vic

What a good idea(s) - article(s) coming in due course.

Dear Sir

We have recently been made aware by telephone enquiries from Telecom Australia and others in the Electronics field and by articles in Trade Publications, of the danger in the use of Beryllium Oxide included in the manufacture of certain components and ancillary products.

It should be very important to Technicians and others who may be handling servicing materials, in particular Heat Transfer compounds, to know that at least one such product - **Bevaloid GS13** - which is manufactured in our Brookvale plant **does not contain Beryllium Oxide.**

We feel that the Electronics Industry should be made aware that there are comparatively 'safe' materials available to them, and the best way to do this is through the pages of your excellent publication, together with other Technical Magazines covering the same field.

N E Blackler
Marketing Officer
Bevaloid Australia Pty Ltd

Dear Sir

I have a query concerning the crystals specified for the ETI Aircraft Band Converter (ETI 721, Mar '79). As suggested, I purchased two crystals, offered by Dick Smith for use in scanning receivers.

I have since found that both crystals seem to be incorrectly marked by the same degree, or, alternatively have been designed for a 10.5 MHz IF.

i.e. Xtal Marking	Oscillator output
124.7	135.2 MHz
118.7	129.2 MHz

Thus, for the receiver to be tuned to the channel specified on the Xtal the second IF would need to be tuned to 10.5 MHz and not 10.7 MHz.

I would be interested to know if the Xtals are incorrectly marked or whether they have been designed intentionally for a 10.5 MHz IF for use in the scanning receivers.

This need not be a problem other than I have Xtals for some other channels with the channel output appearing on 10.7 MHz.

I am also anxious to know whether you have any definite plans to describe a matching 10.7 MHz IF/Audio system to complement the converter and aerial already published.

R J Verrall
Taroona, Tasmania

I spoke to the Service Manager at Dick Smith Electronics, Mr Gary Crapp, about the problem. It seems the crystals may be incorrectly marked. If you return them an exchange will be arranged. A suitable 10.7 MHz IF/audio strip is planned for early next year.

Roger Harrison
Editor

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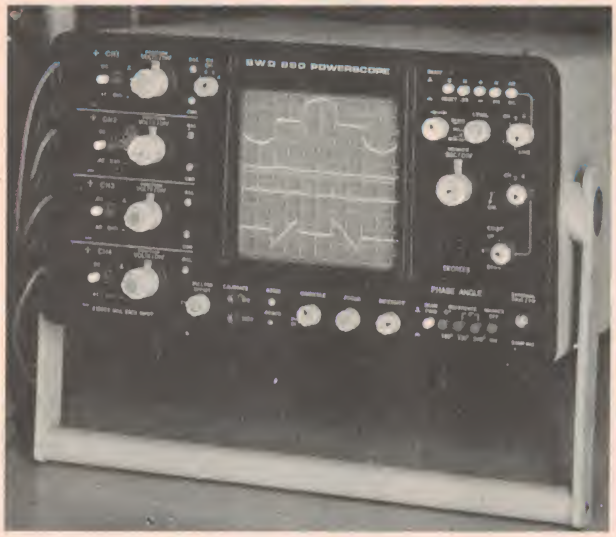

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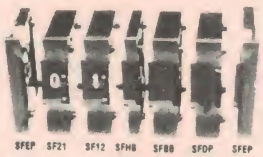

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10	3.465	88.25

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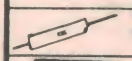

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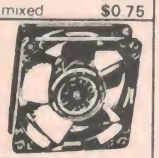

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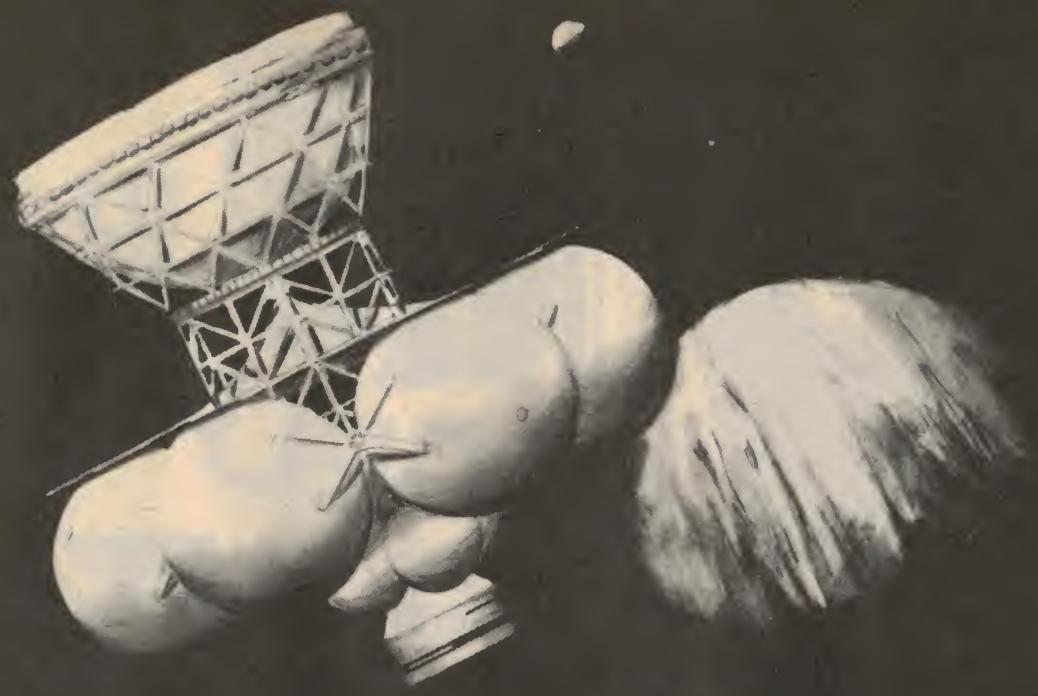


Project DAEDALUS flight of fantasy, or fantastic flight?

Recently, the British Interplanetary Society published a report on 'Project Daedalus'. It was nearly 200 pages long and took five years to write. It's packed with detailed calculations for the design of an interstellar craft. These show that the capability is almost within our grasp. Phil Cohen analyses the results of the report.

THE DAEDALUS PROJECT is a detailed study of the feasibility of building and launching an unmanned interstellar probe. The purpose of such a probe would be to gain information about nearby stellar systems — and especially to search for planets which may contain the first alien life we contact.

The project is the work of the British Interplanetary society, a society which was founded in 1933 with the aim of advancing the space industry in the UK.

The study group which worked on the Daedalus project consisted of a small number of professional scientists and engineers from establishments such as the UK Atomic Energy Authority, British Aircraft Corporation, RAF and City University, London. The work was carried out in their spare time over a period of five years and culminated in the publication of a JBIS (Journal of the British Interplanetary Society) report nearly two hundred pages long, which contained a *summary* of the results of the study!

The intricate report attempts to raise, and find theoretical solutions for, all possible problems which would be involved in such a project and even includes the design of a factory to 'mine' the atmosphere of Jupiter to produce propellant for the Daedalus craft.

The name Daedalus (meaning 'cunningly wrought') is from a Greek legend — Daedalus built sets of wings for himself and his son, Icarus. During their flight, Icarus disobeyed his father's instructions and flew too close to the Sun. The wax holding his wings together melted and he was killed. Daedalus, however, reached his destination without mishap!

The mission

The probe's mission is to fly past Barnard's star, dropping smaller probes which will collect data about the star and any possible planetary system, transmitting it back to earth. To get there, it will need to accelerate to about 12% of the speed of light, that is: 3.6×10^7 metres per second! Barnard's star is some 5.91 light years (Ly) away.

Barnard's star is not definitely known to have planets. Recent observations have shown that the star 'waltzes' slightly, suggesting that its 'dancing partner' is a massive planet, similar to Jupiter. However, this waltz is not pronounced enough to prove, with any degree of certainty, the existence of a planetary system. ▶

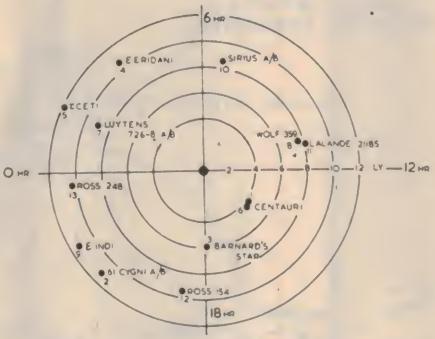
Why Barnard's Star, then? There are two stellar systems closer to us — Proxima Centauri at 4.3 Ly and Alpha Centauri A/B at 4.4 Ly. Alpha Centauri A/B is a double star and must surely be as interesting as Barnard's Star?

The answer is that the Daedalus Project is an attempt, not to design a probe completely, but to provide a design framework for further studies. The design team considered that if it was possible to use a Daedalus-type craft to reach Barnard's Star, it shoud be possible to get to Alpha or Proxima Centauri also.

One major consideration in deciding on the actual 'mission profile' chosen was that it had to yield some sort of results within a human lifetime. This was because it was considered unlikely that any state would undertake a longer-term project!

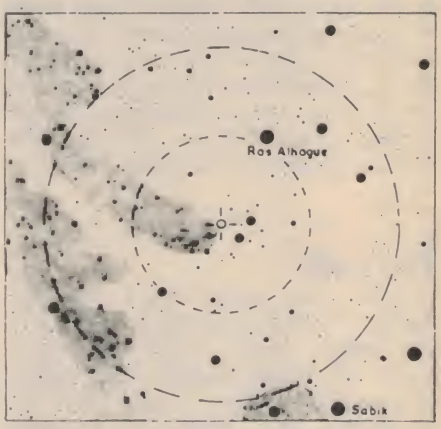
The first twenty years of the project would be spent designing, building and fuelling the craft. It would then accelerate out of the Solar System for 2 years, at which time the first stage would be dropped to save weight. The second stage would take over for another 1.8 years, accelerating the craft to its final, awesome speed.

There would then come a 40-year wait, with the craft transmitting only data about the interstellar medium — the dust concentration, for instance, which would be invaluable for the design of later craft.

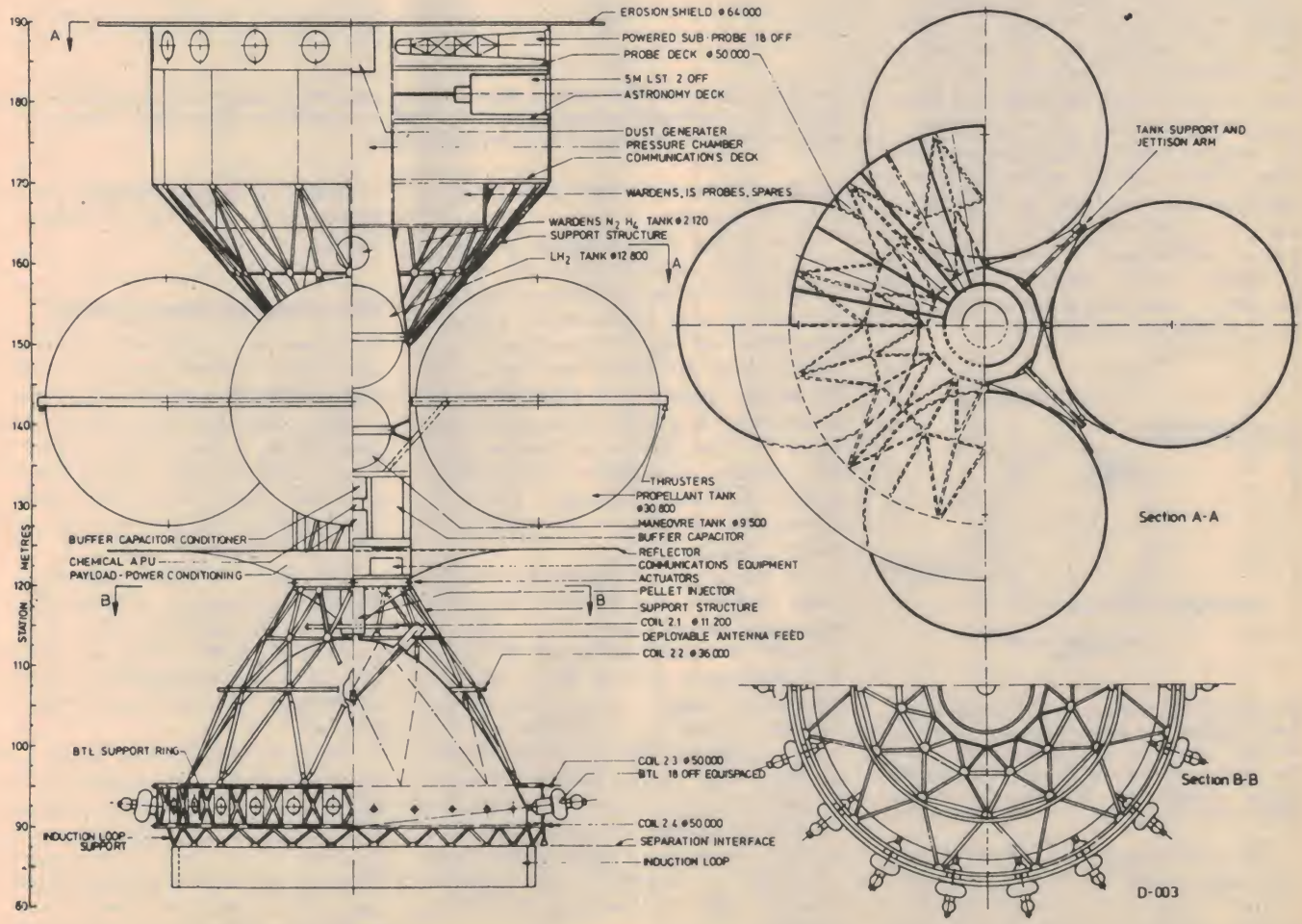


The positions in space of the stars closest to the sun. The figure beside each star is its 'interest' ranking. These were arrived at by taking into account the distance, the 'uniqueness' of the star (how frequently similar types occur) and the probability of habitable planets. The obvious choice for a mission would be Alpha Centauri but the probe was designed to reach Barnard's Star for good measure.

At the end of this period the craft would be close enough to its target to detect the existence of any 'gas giant' planets similar to Jupiter. At about this point it would start to disperse its probes. The dispersal has to take place this soon because it takes a lot of power to change course at that sort of speed and the probes would have to fly past the star itself as well as ▶



Barnard's Star as seen from the Earth. Unfortunately it's not visible to the naked eye. It appears in the constellation of Ophiuchus.



The second stage. This is similar to the first stage but carries the payload — a package of smaller probes to be deployed near the end of the journey.

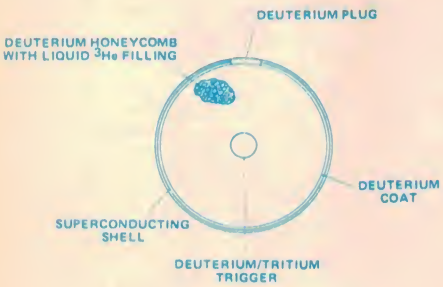
any planets. which may be at wide orbits. The decisions about which direction to send each probe would be taken by the main computer on board the craft. As radio waves would take about five years to reach Earth from the ship by this time (and thus a ten-year wait for a reply!), all decisions would have to be taken by the ship's computer.

As the craft reached the outer limits of the system, the probes would begin to send back information to it. It would relay the information back to Earth, the total transmission time being about three years — the beginning of the message would only be half-way home when the craft stopped transmitting!

The craft

The Daedalus probe has a two-stage engine, the first stage being dropped to save weight when its fuel is finished. These two stages propel the payload of smaller probes, computers for controlling the mission, communications and other equipment.

The first stage weighs over 40 000 tonnes fully fuelled and is about 150 metres long and 190 metres wide. It consists only of a giant motor and six spherical fuel tanks. It burns for about two years continuously at the start of the mission. The designers also took into account which materials would be used for the craft's reaction chamber, for instance, have to stand temperatures from 3°K (3 degrees centrigrade above absolute zero) to 1600°K. This means using an exotic alloy. The one chosen was molybdenum with titanium, zirconium and carbon, internally nitrided — you don't come across alloys much more exotic than that!



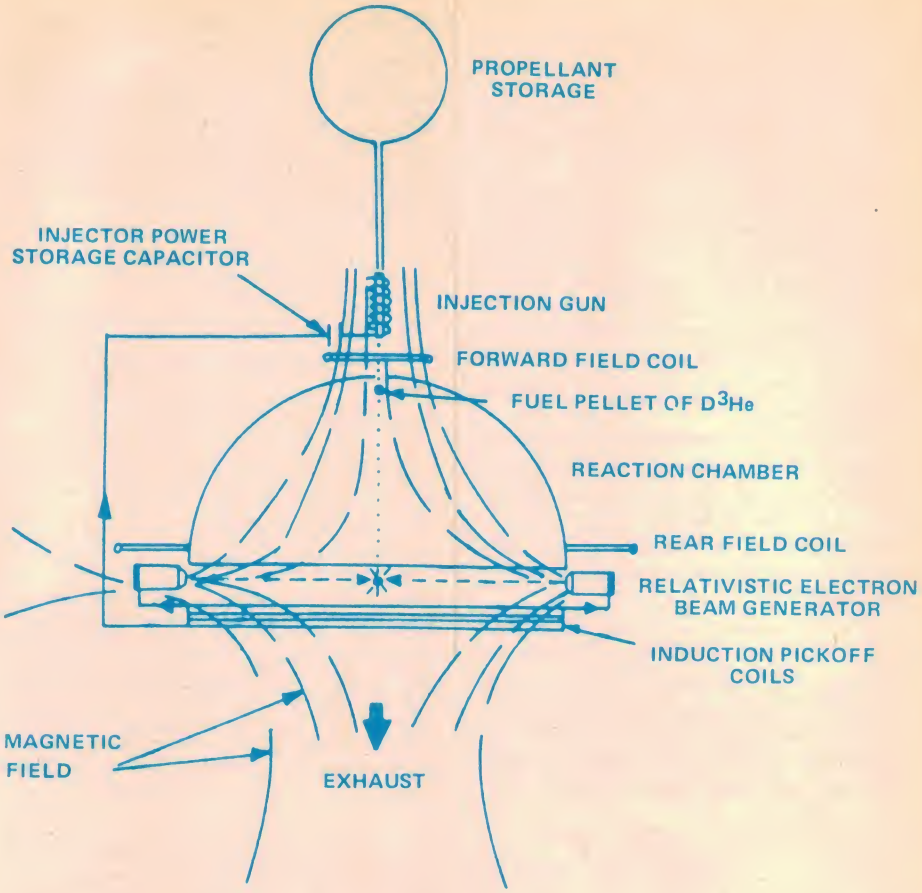
The fuel pellet structure. The superconducting shell enables the pellet handling system to fire the pellet into the reaction area, where the boiling of the deuterium coat generates enough pressure to detonate the 'trigger' pellet. Each fuel pellet is 1 to 2 cm in diameter.

The fuel tanks are dropped during the course of the 'burn' to save weight. As they weigh over 16 tonnes each this is quite a saving. Remember, the fuel is being used up also — the first stage itself, without fuel and tanks, weighs only 100 tonnes.

The second stage is almost the same as the first, except that it's about 1/10th of the mass and about ½ the size. It has four fuel tanks which are also disposable and carries the payload bay. This is about 30 metres long and about 50 metres diameter. It holds (starting at the front) an erosion shield to protect the craft from interstellar dust erosion, the eighteen disposable self-propelled probes, the main telescopes, the communications equipment and computers and the 'wardens'.

As the craft will be on its own for some decades, and as only the most optimistic would expect there to be no failures on board during all this time, it is necessary to have some form of automatic repair. This is where the wardens come in. Controlled by the main computers, they are multi-purpose self-propelled robots, flexible enough to perform any repair or replacement necessary (within reason). The ship would also carry a large complement of spares — hopefully, the wardens wouldn't have to build anything from scratch.

The ship would be 190 metres long at launch and would weigh over 54 000 tonnes — that's a lot of mass to get moving!



The Daedalus propulsion system. This works by controlled nuclear fusion explosions. Solid pellets of a hydrogen isotope mixture are fired on by electron beams and a magnetic field contains the blast. See the text for a full description.

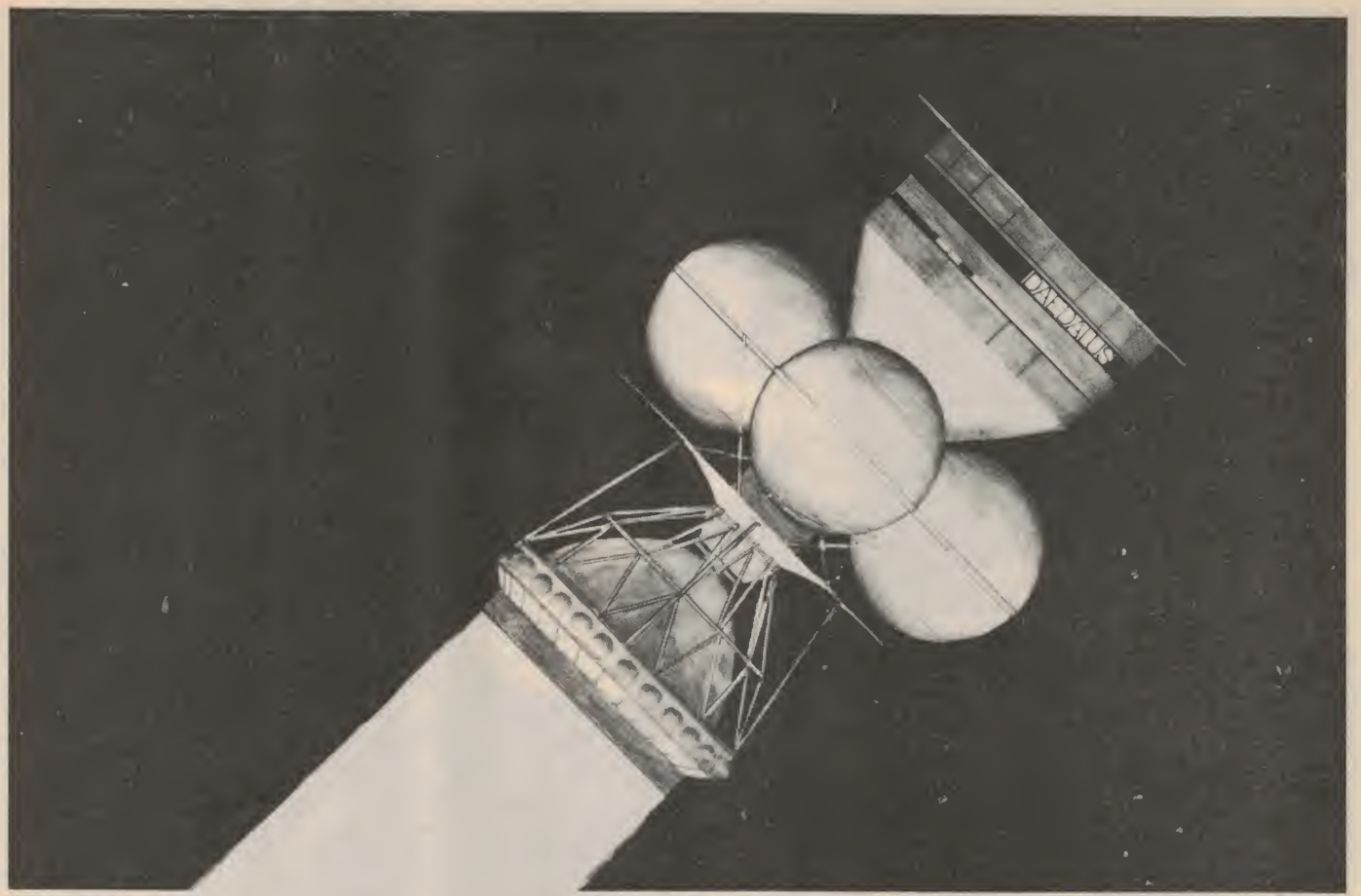
The propulsion system

The starship is propelled by a series of very small nuclear fusion explosions, occurring at the rate of 250 per second.

The Daedalus propulsion system contains the energy of the explosions in a very strong magnetic field and releases it between explosions by squirting out the explosion products at an exhaust velocity of about 10^7 m/s.

The fuel for these explosions is a mixture of isotopes of hydrogen and helium in a solid fuel 'pellet' about 10 to 20 mm across. These are stored in fuel tanks at a temperature of 3°K (3°C above absolute zero) to keep them from melting!

The pellet structure is rather similar to a particular brand of sweet — a thin hard coating and a honeycomb centre. The coating is not made of chocolate, however, but of a superconducting material. This makes it possible to shoot the pellets into the reaction area by magnetic means at an acceleration of about 10^6g. This phenomenal acceler-



Gavin Roberts

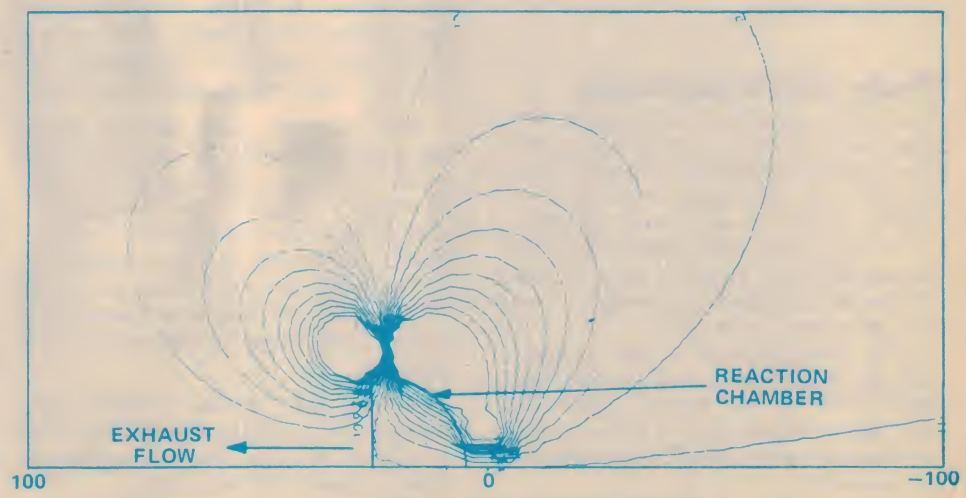
ation is necessary so that they can cross the gap between the pellet ejection system and the ignition point between the time when the last explosion has died down and the next one is required to start. As this happens 250 times a second, this crossing has to be fairly fast.

Once at the ignition point, beams of high-energy electrons are shot at the pellet. This vaporises the outer shell instantaneously, which increases the pressure and temperature of the centre to the levels required to ignite fusion. The ignition is helped by a 'trigger' particle in the centre.

The expanding plasma is trapped by immensely strong magnetic fields set up by two coils surrounding the engine. The coils generate a peak field intensity of around 14 Tesla and are cooled by liquid helium flowing through the hollow conductors to keep the temperature down to 4°K. The field is deformed by the explosion and (hopefully) contains it and keeps it within the reaction chamber – exactly like the 'magnetic bottle' which can be used to contain nuclear fusion reaction in terrestrial fusion power generating stations.

One of the reasons for choosing the particular fuel used is that very little of the reaction energy is released as neutrons. This means that the engine is relatively 'cold' (in radioactive terms only!), as the electrons and protons from the reaction can be trapped magnetically, whereas neutrons cannot. This lack of neutrons means that very little shielding is needed to protect the rest of the ship – a weight saving.

Unfortunately, the fuel is rare on Earth and this brings its own problems. For the entire mission, about 3×10^{10} fuel pellets would be required – with a total mass of around 50 000 tonnes. This would consist mainly of 30 000 tonnes of helium-3 and 20 000 Tonnes ▶



A computer-generated cross-section of the area around the reaction chamber, showing the magnetic field profile. The peak field generated in the coils would be about 14 Tesla.

Gavin Roberts

....flight of fantasy, or fantastic flight?

of deuterium. As these are both very rare they have to either be produced artificially on Earth or 'imported' from elsewhere.

Probe debris protection

The chunks of rock which plagued Dan Dare and his ilk by ploughing through the walls of spacecraft during gaps in the plot are not as numerous in interstellar space as was once imagined.

In the main, the matter which will be encountered between stars consists of ionised and neutral hydrogen clouds and very fine dust grains.

The average mass of the grains is thought to be about 0.1 pg (or 10^{-16}kg). While this is not exactly enormous, the craft will hit quite a large number of them, all at a velocity of 32 000 km per second!.

There are two problems to be countered — the heating effect of the ionised gasses (as large numbers of high energy protons and electrons hit the vehicle) and the erosion caused by the impact of the dust. The designers predict that the erosion shield of the probe will reach a temperature of 193°K — well within reasonable limits.

The material used for the shield will probably be boron and the report concludes that a thickness of 9mm of boron will survive dust erosion long enough to protect the vehicle from the X-rays produced by the impact of protons and electrons (and of course the protons and electrons themselves) during the course of the entire coast period.

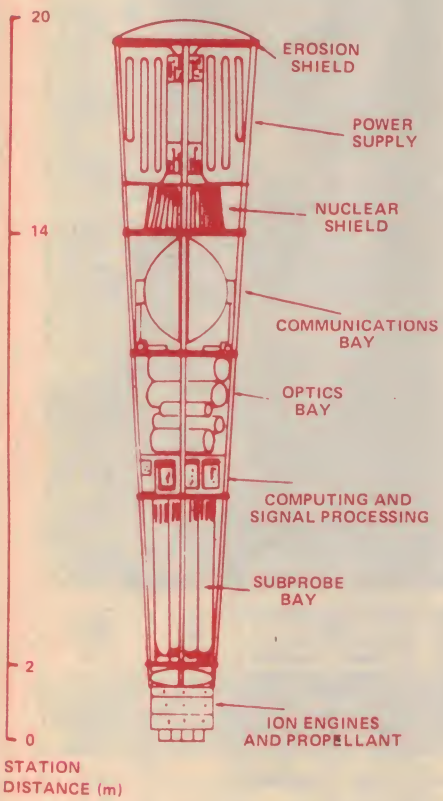
When the probe reaches the Barnard's Star System, however, it will encounter the same problem again, but on an entirely different scale.

The target system, if it's anything like our own, will be full of all manner of junk — ranging from material the same size as the interstellar dust all the way up to asteroids weighing up to 10^{12} tonnes! Of course, the likelihood of meeting something large is small, so to speak. The designers of the probe took as a target protection against a 0.5 tonne object.

To protect the vehicle against half-tonne rocks coming towards it at 32 000 km per second is not as difficult as it sounds, luckily! The system used is to fly a small chemically-propelled vehicle about 200 km ahead of the main probe and use it to deploy a smoke cloud about 100m thick and with a total mass of 6 kg. While this seems rather insubstantial, the calculations show that anything under 500 kg will be totally vaporised on meeting this cloud and that the expanding vapor will be too thin to harm the vehicle when it passes through it, 200 km behind the smoke cloud and 0.005 seconds later.

It seems that you can stop anything if only it's moving fast enough!

A similar method would be used to protect the smaller probes which are shot into other parts of the target system. The probe couldn't really be said to fly past the Barnard system – it punches several holes in it and flies *through* it!



One of the subprobes. These would fly through the target system, sending information to the main craft which would relay it back to Earth.

Subprobes

Most of the information to be gained about the target system will be via the 220 tonnes of smaller probes the mother ship will carry. These will be 'launched' some distance from Barnard's Star and will follow carefully-planned trajectories through the system, transmitting information back to the main vehicle.

The probes (18 in all) would be designed for specific tasks – three for terrestrial plants, five for stellar physics etc.

They would each contain a debris protection system similar to the main ship's. In fact, there would be nineteen holes punched in the target systems detritus! There is an important principle in physics which states that you can't study anything without changing it – that's certainly true here.

The Daedalus craft would also carry five 'interstellar medium probes' for finding the shape of variations in dust concentrations, for example. These would be spread around the mother craft (three at a time, with two in reserve) at a distance of 1000 to 10 000 km. When the craft flies through the edge of a cloud of dust, the information from all four sources (including the main vehicle) would give information about the shape of the edge and how the dust varied throughout the cloud.

Communications

Naturally, it will be useful for the probe to be in contact with the earth at all times – it should be capable of sending information back and receiving major 'policy change' messages.

During the boost phase, a large plume of plasma (dissociated sub-atomic particles) will trail the vehicle, making microwave communications impossible. For this reason the probe will carry a communications laser for use during the early period of the mission. This system will have a bandwidth (frequency response) of 20 kHz and a range of one light year (32 000 km per second over one year). This requires a laser with a peak power of 1.3 MW, operating in the infra-red (which the plasma would be transparent to).

When the boost phase finishes, the craft will deploy a microwave transmitter/receiver which will be mounted in what was previously the reaction chamber, using the chamber to focus the microwaves. This would operate at 2.24 – 3.02 GHz and would have a data rate of 864 k baud (864 000 bits/second). The range would be about seven light years – sufficient for the 'Post-encounter' transmission of data about the interstellar medium on the far side of the target system. One thing which had to be taken into account in designing the system was that transmissions would be received at a lower frequency due to the Doppler effect!

Less powerful transmitters and receivers would also be required for communication with the disposable probes and the wardens.

The computers

Perhaps the one aspect of the Daedalus project which will require the greatest extension of present-day capabilities is the self-repair function.

The concept of the multi-purpose 'warden' robots is all very well but these are, after all, only as intelligent as the software (computer programs) which control them.

All the way through the report the wardens crop up as a sort of *deus ex machina* for repair and even improvement of the craft.

As was mentioned before, the speed of radio waves limits the amount of control from the earth to an absolute minimum. The report shows, by extrapolating data from military and commercial aircraft, that a long flight without on-board repair is not feasible.

This means, in effect, that before the project is undertaken there must be a major advance in the state of what is known as 'artificial intelligence'.

The ability of modern computers to deal with predictable repairs – items which will inevitably wear out in a certain way – and such other tasks as will be known in advance is probably adequate when projected to the mission date. However, the complete inability of software as it stands at present to deal with a) un-predictable events and failures and b) failures *in the software itself* is discouraging.

Then again, looking back at the advances in computing in the last few years . . . who knows?

The memory capacity of the system, calculated from the amount of information to be stored during flypast for transmission back to earth, is about 3×10^{10} bits. Using the latest in high density information storage – the magnetic bubble memory – this would require about 200 000 integrated circuits, weighing 1½ tonnes!

Summary

The Daedalus Project makes fascinating reading. What is most impressive is the level of detail to which everything has been thought out. For instance, the material used for the insulators in the electron beam generators (part of the engine) was chosen to be beryllia, which has the required mechanical and electrical properties. The mere fact that the designers have gone into such detail lends the report much credibility.

The whole thing is written in a clear (if highly technical) manner with references to all sources of data – all in all a very impressive work – but what use is it?

The report will have several effects. One will be to swell the ranks of the British Interplanetary Society. Another may be the serious consideration at some time in the future of a Daedalus-type project. It's worth noting that the same society produced a feasibility study on a lunar mission some *thirty years* before Apollo 11! ●

Further information on the BIS is available from: The Executive Secretary, The British Interplanetary Society, 12 Bessborough Gardens, London, SW1V 2JJ, England.

TRIACS

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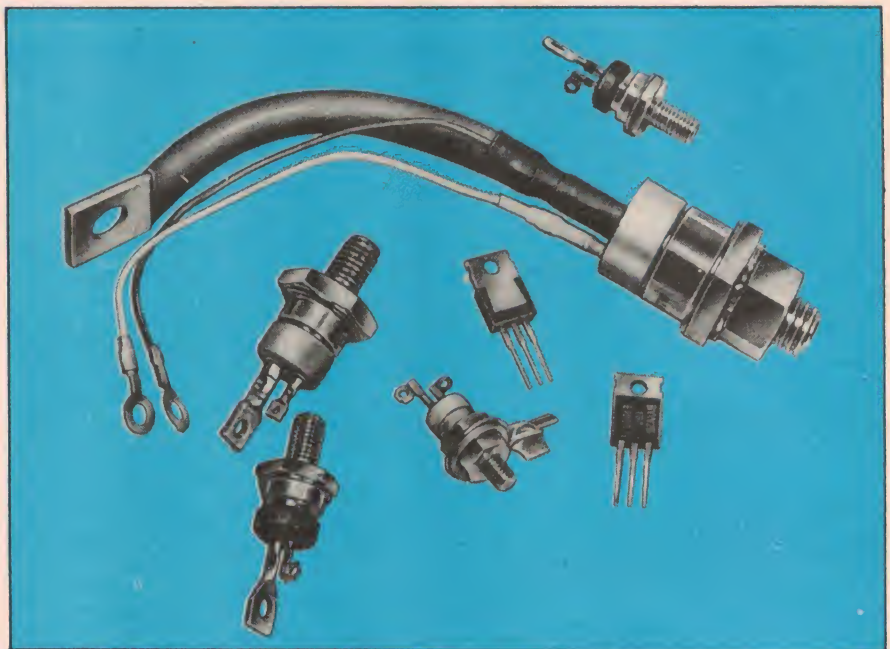

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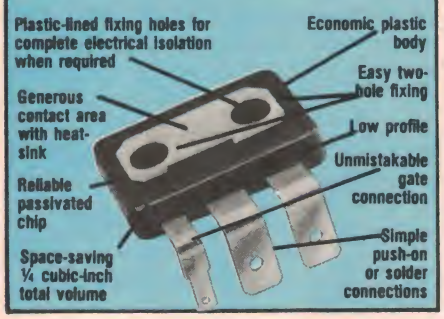

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P.O. Box 50, Lane Cove.
N.S.W. 2066
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BASIC DATA: In order of current rating

Type No.	Encapsulation	RMS on-state current $I_{T(RMS)}$ max.(1)	Repetitive peak off-state voltage V_{DRM} max.	Non-repetitive peak on-state current I_{TSM} max.	Rate of rise of on-state current dI_T/dt max.	Rate of rise of off-state voltage dV_D/dt max. Normal	Rate of rise of off-state voltage dV_D/dt max. Commutating*	Gate trigger voltage V_{GT} min.	Gate trigger current I_{GT} min.
BT137-500 -600	TO 220 plastic	6A	500V 600V	55A	20A/µs	50V/µs	6V/µs (5A/ms)*	1 5V	35mA
BT138-500 -600	TO-220 plastic	10A	500V 600V	90A	30A/µs	50V/µs	4V/µs (5A/ms)*	1 5V	35mA
BTW43-600G -800G -1000G -1200G	TO 64 metal (Metric thread)	12A	600V 800V 1000V 1200V	120A	50A/µs	50V/µs	10V/µs (5A/ms)*	2 5V	100mA
BTW43-600H -800H -1000H -1200H	Same as BTW43 600G to BTW43 1200G series shown immediately above except for commutation						10V/µs (12A/ms)*		
BT139-500 -600	TO 220 plastic	15A	500V 600V	115A	50A/µs	50V/µs	4V/µs (8A/ms)*	1 5V	35mA
BTX94-400H -600H -800H -1000H -1200H	TO 48 metal (UNF thread)	25A	400V 600V 800V 1000V 1200V	250A	50A/µs	100V/µs	30V/µs (25A/ms)*	3V	150mA
BTX94-400J -600J -800J -1000J -1200J	Same as BTX94 400H to BTX94 1200H series shown immediately above except for commutation						30V/µs (50A/ms)*		
BTW41-500G -600G -800G	SOT 80 plastic	40A	500V 600V 800V	260A	50A/µs	100V/µs	5V/µs (12A/ms)*	1 5V	75mA
BTW41-500H -600H -800H	Same as BTW41 500G to BTW41 800G series shown immediately above except for commutation						5V/µs (23A/ms)*		
BTW34-600G -800G -1000G -1200G -1400G -1600G	TO 103 metal (Metric thread)	55A	600V 800V 1000V 1200V 1400V 1600V	400A	50A/µs	200V/µs	30V/µs (25A/ms)*	2 5V	200mA
BTW34-600H -800H -1000H -1200H -1400H -1600H	Same as BTW34 600G to BTW34 1600G series shown immediately above except for commutation						30V/µs (50A/ms)*		

(1) For derating curves see individual data sheets *The figures in brackets following the dV_D/dt rating show the $-dI/dt$ of the preceding turn off

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The extraordinary inventions of Sir Joseph Swan

C.L. Bolz

One hundred years ago he gave the first public demonstration of the incandescent-filament lamp. Together with Edison, his name is incorporated in the trademark of Ediswan light globes — produced to this day by the Thorn Electric Company.

His invention brought about the establishment of the electrical engineering industry. Apart from that he contributed much to the technology of photography — he patented bromide printing paper, as still used today — he greatly improved the secondary cell and worked on early fuel cells. His contribution to 20th century technology has been far-reaching.

THE BRITISH ASSOCIATION for the Advancement of Science recently sponsored celebrations in Newcastle-upon-Tyne, North East England, to commemorate the centenary of the first-ever public demonstration of an incandescent-filament electric lamp.

The man who gave the demonstration in 1879 was Joseph Swan, a North-country Englishman who was to prove one of Britain's most remarkable inventors, responsible for innovations that are still with us today and for the start of the electrical engineering industry.

He had but a rudimentary education, which pleased him because the casualness of it all allowed him to learn, while very young, about a wide range of crafts from ironwork to rope-making, about coal-gas and about electricity. He learned by very close observation and through the friendly interest craftsmen showed to an eager, wide-eyed, knowledge-seeking boy. On leaving school at 13 he was apprenticed to a firm of druggists and so began to learn chemistry.

He grew up with several brand new branches of technology – photography, electro-plating, batteries and the production of vacuum.

"The elation created by the announcement of a great discovery and first acquaintance with its results," he wrote later on, "is a sensation of an extraordinarily uplifting character, and I can never forget its effect as a stimulus to experimental effort."

The electric lamp

It was in Sunderland, his birthplace that, at the age of 17 the seed was planted that led him to his most famous inventions in electric lighting. He read about a new type of electric lamp, patented in 1845, that made use of an electric current passing through a wire in a vacuum. He also heard about it in a lecture and saw the principle demonstrated.

In 1846, at the age of 18, he joined a friend in a chemist and druggist business in Newcastle-upon-Tyne, where all his subsequent work on incandescent lighting was done until 1883.

The seed of 1845 germinated because of a remarkable development in vacuum technology from 1855 onwards, starting with the German inventor Heinrich Geissler. It was the invention of the mercury pump. Before this was available all efforts to make a conductor incandescent in an evacuated bulb failed because the conductor either melted or burned away in the oxygen of the remaining air.

The pressure attainable up to 1855 was about 13 mm of mercury (13 torr in modern terms). The mercury pump achieved 10^{-3} torr, which seemed (naively as we now know) nearly a perfect vacuum.

It inspired Swan to start experimenting. He realized that a material of very high melting point was needed and he chose carbon. He also knew that he needed the carbon very thin so that more power could be concentrated in a small space, to make a sort of super candle so to speak, or to achieve the 'subdivision' of the electric light, as it was quaintly expressed in those days. He also needed the carbon to be flexible so that it could be bent into shape. It was a great challenge to his ingenuity and his considerable manipulative skill.

In the 1860s he succeeded in 'carbonizing' strips of paper by a technique of his own, which was what we would today call pyrolysis. That is, heating to a very high temperature in the absence of oxygen. The resulting strips were remarkable, being flexible and metallic.

Adsorbed air

Lamps made with the strips were, nevertheless, a failure. There were difficulties in connecting the strip to the platinum wires used to bring the ▶

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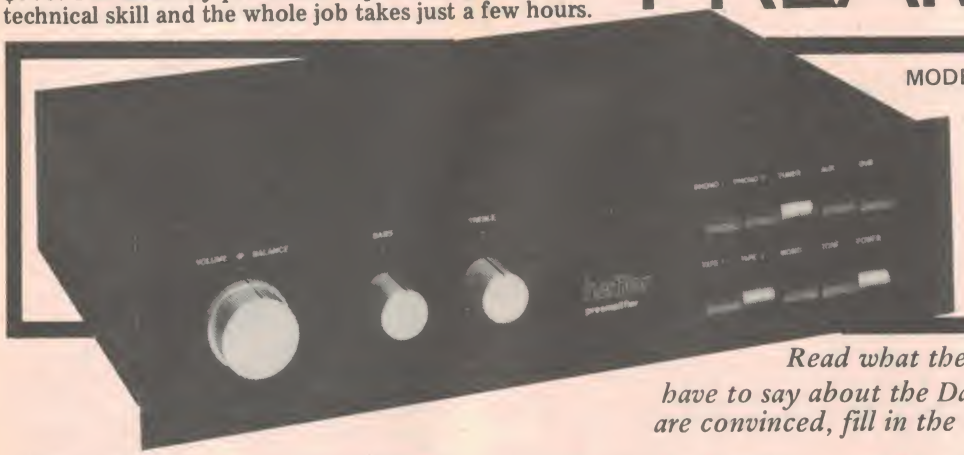

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STEREO REVIEW

"but its performance is literally 'state of the art'. Its distortion is virtually unmeasurable . . .' 'All noise levels are inaudible and, with 'A' weighting, are very difficult to measure'. '. . . quite possibly the most highly refined preamplifier one can buy (in terms of sheer performance)'. '. . . we have been informed by those who have built the kit that it is very simple, and that even a neophyte should be capable of assembling a properly performing preamplifier in a few hours or so.
POPULAR ELECTRONICS

"This unit has much of the punch and definition of the finest solid state preamplifiers that I have listened to. But the most amazing thing about the Model DH — 101 is not the bottom end, but what the unit does in the midrange and top. This is the first preamplifier I have heard that not only spreads an orchestral stage to an extreme left and extreme right, but also spreads this stage in a near perfect rectangle to the rear'. 'Like the very finest preamps that I have listened to, the Hafler has phenomenally good definition and inner detail.
ABSOLUTE SOUND

"The overall sound quality of the Hafler preamp is first rate. It has absolutely no irritating qualities, is very clean, very quiet, very neutral'. 'The audiophile who either can't or won't spend several weeks pay for a preamp no longer has to settle for something less than the preamp of his dreams.
AUDIO CRITIC

"In sum, we were surprised that this preamplifier is not being offered to the audiophile at twice its recommended retail price, because even at that level it would be worth every cent.
STEREO BUYERS' GUIDE — AMPLIFIERS

*the David Hafler DH-101 preamplifier: Specifications

PHONO PREAMP SECTION

Type: Discrete transistor (no integrated circuits) **Rated output:** 3 volts 10 Hz to 100 kHz **Maximum output:** 7 volts 20 Hz to 20 kHz **Distortion:** Less than .0006% @ 1 kHz and 3 volts out **Slew rate:** 12 volts per microsecond **Phono overload:** 180 mV @ 1 kHz, 1.8 volts @ 20 kHz **Phono cartridge interaction:** @ 20 kHz none **Hum and noise:** "A" weighted 86 dB below 10 mV 1 kHz input **Frequency response:** Complies with RIAA specification 40 Hz to 15 kHz ± 0.5 dB **Hi-pass filter:** In accordance with proposed RIAA revision (IEC publication 98, Amendment No.4, Sept 1976) **Gain:** 34 dB @ 1kHz **Input impedance:** 47 kΩ in parallel with 270 pf*

*Input capacity can be modified to conform with cartridge requirements. Above value must be added to capacity of connecting cables to get total cartridge load.

TONE CONTROL SECTION AND HIGH LEVEL AMPLIFIER

Type: Discrete transistor (no integrated circuits) **Rated output:** 3 volts 10 Hz to 100 kHz **Maximum output:** 7 volts 10 Hz to 100 kHz **Distortion:** Less than .001% 20 Hz to 20 kHz **Slew rate:** 12 volts per microsecond **Rise time:** 2 microseconds **Hum and noise:** "A" weighted 90 dB below 1 volt **Frequency response:** +0.0, −0.25 dB 20 Hz to 20 kHz **Gain:** 20 dB ± 1 dB **Input impedance:** Greater than 25 kΩ **Square wave and pulse response:** Excellent! **Bass control:** Type: Moving inflection with variable turnover Amount: ± 12 dB @ 50 Hz **Treble control:** Type: Shelving with fixed turnover frequency Amount ± 10 dB @ 20 kHz

GENERAL SPECIFICATIONS

Number of semi-conductors: 28 transistors, 2 integrated circuit power supply regulators, 4 diodes, 1 LED **Inputs:** Two phono, tuner, auxiliary, two tape recorders **Outputs:** Two tape (buffered) and one program **Provision for patching in external equipment Controls:** Volume, balance, bass treble, dub, switching of inputs, mono-stereo, tone control defeat, power on-off **Intermodulation distortion:** At normal levels of operation IMD, whether SMPTE or CCIF, from phono input to preamplifier output is below the residual of currently available instruments **AC voltage:** 100-130 and 200-260, 50/60 Hz **Power consuption:** 3.5 watts **AC convenience outlets:** 2 switched, 5 amp continuous, 72 amp surge; 2 unswitched, 5 amp continuous **Designed to requirements of Underwriter Laboratories Specification UL-1270 Size:** 13.75" wide x 3.25" high x 8.38" deep (35 x 8.25 x 21.3cm) **Shipping weight:** 9 lbs. (4 Kg)

All specifications are subject to change without notice

Guarantee: The parts in a DH — 101 kit are warranted for a full year from the purchase date. If a defective component is found on a circuit board or in a kit, simply return the individual part to Concept Audio prepaid together with the serial number and the date of purchase, and it will be replaced at no charge. If you cannot locate what is wrong with your DH — 101 return it to Concept Audio along with a copy of the dated bill of sale and a cheque for $25. If the difficulty is a defective part, the unit will be returned to you together with your $25. If the problem is found to be an error in your assembly of the unit, the unit will be put in proper working order and then returned to you freight prepaid. This warranty is void if the kit has not been completely assembled or if other than rosin core solder has been used. Units assembled with acid core solder or paste flux will be returned unserviced.

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electricity into the glass bulb. In addition, carbon was deposited on the inside of the glass when the lamp was running, making it opaque. Against the opinion of all colleagues and academic judgement he decided that this was caused by the poor degree of vacuum and the release of adsorbed air during incandescence.

He then had a flash of intuition that solved the problem. Towards the end of the evacuation process by mercury pump he flashed a high current through the carbon. It removed adsorbed gas and created a higher vacuum. This leap in technology was made in 1878 and the technique has been used ever since.

He was still searching for a better conductor that would lend itself to mass production and be easily connected to the platinim leads. He made at first very thin carbon rods and he showed his first successful lamp with a carbon rod one millimetre in diameter to the Newcastle-upon-Tyne Chemical Society on 18 December 1878. On 3 February 1879 he gave a public lecture-demonstration to an audience of some 700 people in the premises of the Literary and Philosophical Society of Newcastle.

The possibility of the 'subdivision' of electric light was by this time a subject for public discussion in newspapers. Swan's name became widely known. He continued his work on a new type of conductor and eventually produced a remarkable carbon filament, though he did not use the word.

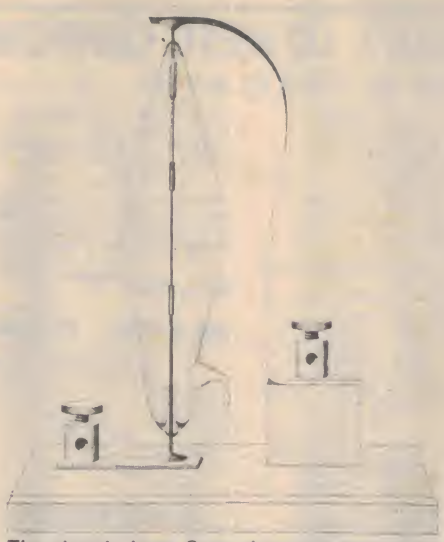
By this time he had a rival, the young American inventor, Thomas A. Edison, who early learned the value of publicity. Reports, later shown to be premature, flashed across the Atlantic to the effect that Edison had finally solved the problem of the 'subdivision' of electric light, and the confident news at first caused a slump in gas-company shares.

It is interesting that Swan did not patent his first electric lamp of 1878-9 because he considered that the basic idea was well known and therefore not patentable. Edison had no such self-restraint and on 10 November 1879 he applied for, and gained, a British patent embodying the idea of a carbon filament. Legally, therefore, he is the inventor of the incandescant-filament electric lamp, though the word 'inventor' is misleading here, for the basic notions were well established.

Swan was not being naive in this, for he had started patenting his inventions in 1864. However, spurred on by Edison's sharp rivalry he rushed to patent his flash technique of evacuation two years after he had invented it.

Lighting homes

With his own lamp development he was very successful. He converted cotton into a transparent resin by means of sulphuric acid, a process he called parchmentizing. The resin was easily cut and shaped into filaments that were strong and flexible and could be carbonized by pyrolysis to make carbon 'wire'. He formed a company in Newcastle to make the new lamps. There were problems still of outside connectors and easy replacement and so on, but he lighted the homes of several eminent people as well as the shop of and enterprising Newcastle linen-draper. The Royal Navy took up his electric lighting. Many public buildings were lighted.



The electric lamp Swan demonstrated to the Newcastle Literary and Philosophical Society in February, 1879. The conductor was a carbon rod about 1 mm thick.

The incandescent lamp had arrived.

At that time anyone wishing to have the new electric lamps needed his own generator, driven by gas or steam. There was no general supply of electricity. But the demand raised problems of generation, transmission and distribution, involving the making of cable; there were problems of switching, too. The solution of these problems established the electrical-engineering industry. The first power station in the world was built at Holborn Viaduct, in London, at the beginning of 1882 by Edison's company.

This lively inventor's aggressive attitude led to a period of litigation, real or threatened. It is not necessary here to go into all the details of the confrontation. It is enough to say that Swan led the field and Edison was very quick to catch up. Eventually, the two men joined in the Edison and Swan Electric Lamp Company.

The trade name *Ediswan* still survives in lamps now manufactured by Thorn Electric in Britain.

Up to 1883 Swan's filaments, made by carbonizing cellulose, controlled the market while Edison's commercial filaments were carbonized slivers of bamboo. Then Swan produced yet another remarkable invention. He created a cellulose plastic and squirted it through a fine hole so that it formed a fine continuous fibre.

This process was suitable for mass production and the pyrolysed fibre made carbon filaments that were homogeneous and of constant diameter. From 1884 onwards all Swan lamps had these carbon filaments. They were the basis of all electric incandescent lamps until tungsten came into use in about 1905. The carbon filaments continued to produce blackening of the glass but only after a useful length of life.

Swan in this process was in fact producing cellulose acetate fibre, the first 'artificial silk'. Mrs Swan crocheted some of the finer fibres into table mats but Swan himself took the matter no further. Some of his assistants – he was shrewd in his selection of them – were later involved in the artificial-silk industry for a long time.

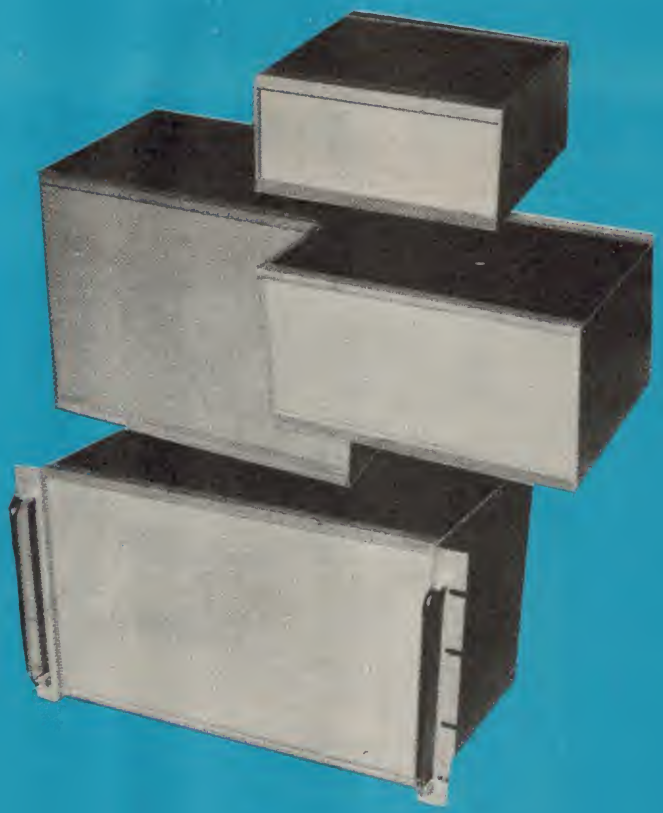
Patents

In outline something should be said about his other inventions. He first produced collodion successfully in 1856 for use in photography and his method is still used. He patented the so-called carbon process for making accurately-graded prints from negatives in 1864. He applied the method to copper-plate etching. He patented the chrome treatment of leather in 1866. He contributed original discoveries to the development of dry photographic plates and he patented bromide printing paper, as still used to-day, in 1879.

Swan greatly improved the then new secondary cell, or accumulator, by introducing the cellular lead plate filled with spongy lead; he patented it in 1881. After his move to the London area in 1883 he continued work on a range of problems including the behaviour of dielectrics under electric discharge, leading to improvements in induction coils and transformers. He tried for years, with great skill but no success, to create an electric cell with an imperishable electrolyte, anticipating the modern fuel cell by using oxygen and hydrogen as electrodes and a ceramic as a porous electrolyte.

By the 1890s he was a famous man, called upon to serve on councils and committees. Many scientific societies awarded him medals. He was elected Fellow of the Royal Society in 1894, when he was 66 years old; King Edward VII knighted him in 1904. He remained mentally alert throughout his life and was experimenting to the end. He died in his 86th year in May 1914. ●

ADAPTABOX



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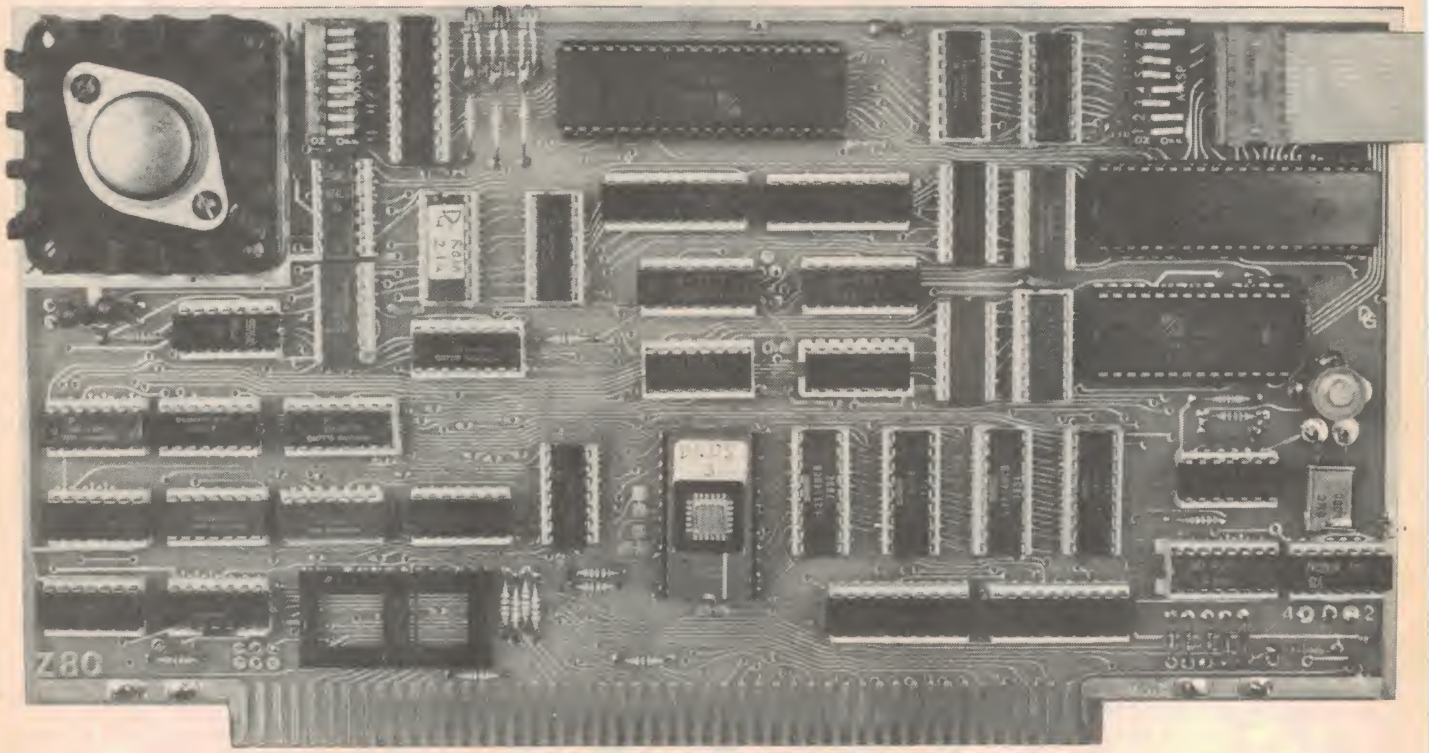
A Z80-based central processing unit using the S-100 bus system

David Griffiths



THE Z80 MICROPROCESSOR, designed by Zilog and second-sourced by Mostek, is currently one of the most popular 8-bit microprocessors on the market. The Z80 is an enhancement of the mass selling Intel 8080/8080A microprocessor. It retains 8080 software compatability (i.e: almost any 8080 program can be run on a Z80, but not vice versa) and hence the enormous quantities of already available 8080 programs can still be utilized on the Z80. These programs include a selection of Tape Operating Systems, Disk Operating Systems, Editors, Assemblers and several of the popular high level languages such as BASIC, FORTRAN and Pascal. With the high cost and effort involved in software development, this compatability is one major factor contributing to the Z80's popularity.

In addition however, the Z80 has an expanded instruction set, many additional registers, improved hardware interfacing and 4 MHz operating capability.

Before going any further, I would like to counter the argument that a beginner may find the Z80's 158 instructions more bewildering than something like the 8080's 78 instructions. This is not at all true, because a beginner need only be aware of a small subset of the instruction set when first programming. Also, the expanded instruction set provides many instructions and additional addressing modes that make programming easier.

The above points regarding the instruction set are not going to directly affect you if you are not going to be doing machine code/assembler programming. If you intend using a high level language, such as BASIC, then the Z80's instruction set will give more efficient use of memory space and faster program execution.

Printed Circuit Board "real estate" works out expensive, therefore the design concept with this CPU board was to include as many facilities on the board as practical. By doing this the board is self-contained with its own I/O (Input/Output), memory, real time clock and several other facilities that usually require adding accessory boards.

In conjunction with the on-board monitor program in ROM (read only memory) and an ETI-640 (DG 640) VDU, it is possible to operate this CPU board as a complete microcomputer by connecting a keyboard to one of the I/O ports and video monitor.

On-board memory

There are 2 kilobytes (2K) of EPROM

(erasable programmable read only memory) for the monitor program and 2K of RAM (random access memory) on the board. (Just under 300 H (Hex) bytes (3 x 256) of RAM is used by the monitor).

The ROM is intended to be a single supply, 2K x 8, 2716. However, due to current availability problems and the fact that single supply ROMs are considerably more expensive than triple supply ROMs, provision has been made on the board to use a triple supply ROM by cutting three links and adding some zener diodes. The RAM uses four 2114 chips (1K x 4 bits each).

The on-board memory is configured as a 4K block with the ROM below the RAM. The 4K block can be located at any 4K boundary in the memory map by use of wirewrap links, or it can be completely disabled if desired.

This is certainly not all the memory that you will ever need but it is more than sufficient for initial checkout and limited programs. This means that when you first get the board running you don't have to add a memory board before you can run programs. (See the diagram for memory addressing details).

On-board I/O

The board includes one parallel unlatched input port and a Z80 PIO chip that can be programmed as required. The parallel input port is intended to be used with eight sense switches on a front panel, however this is just one of many possible uses.

The PIO comprises two separate 8-bit ports that can be programmed as input, output, bi-directional (Port A only) or in bit mode as eight independant bits (mixed in or out). The PIO can be programmed to interrupt in any of these modes.

The on-board I/O occupies 10 Hex consecutive addresses from the Z80 I/O address range of 100H. It can be strapped to occupy any of four locations:

00-0FH
40-4FH
80-8FH
C0-CFH

The monitor program uses the I/O in the lowest address position (00-0FH).

The I/O addressing within this range is as follows:

00_H	PIO	Port A Data
01_H		Port A Control
02_H		Port B Data
03_H		Port B Control

04_H	CTC	Channel 0
05_H		Channel 1
06_H		Channel 2
07_H		Channel 3
08_H		SWP CNTRL/Status
09_H		Parallel i/p port
OA, OB_H	PIC	Not used
OC_H		Data
OD_H		Control
OE, OF_H		Not used

CTC and real time clock

A Z80 CTC (counter timer circuit) is provided on the board for interval timing applications or counting external events. The CTC comprises four independent channels that can each be programmed as timers or counters. As timers they will count multiples of system clock (16 x or 256 x) and then cause an interrupt after a programmed number of counts (up to 255). This gives a timing range of between 8 μs and 32.6 ms with a 2 MHz clock rate. When programmed as a counter, the CTC channel will count transitions (up to 255) on an input pin and can be made to interrupt after a given number of transitions.

The real time clock (RTC) is implemented by providing channel O of the CTC with a 200 Hz clock signal. The monitor software makes the CTC interrupt after 200 counts and thus the processor is interrupted at 1 Hz. The software simply increments a counter to give 'time of day' or elapsed time.

Channel 1 (of the CTC) has the one-second output of channel O connected to its input, so ch. 1 can be used to time for up to 255 seconds.

The use of the CTC and real time clock allow accurate time delays to be implemented in programs without the program being bound by timing loops.

Power On Jump (POJ)

This facility allows the execution address after a system reset or at initial power on to be selected by a DIP switch. Thus the processor can be made to execute a ROM located on any 100 Hz boundary in memory, leaving the addresses at the bottom of memory clear for applications programs.

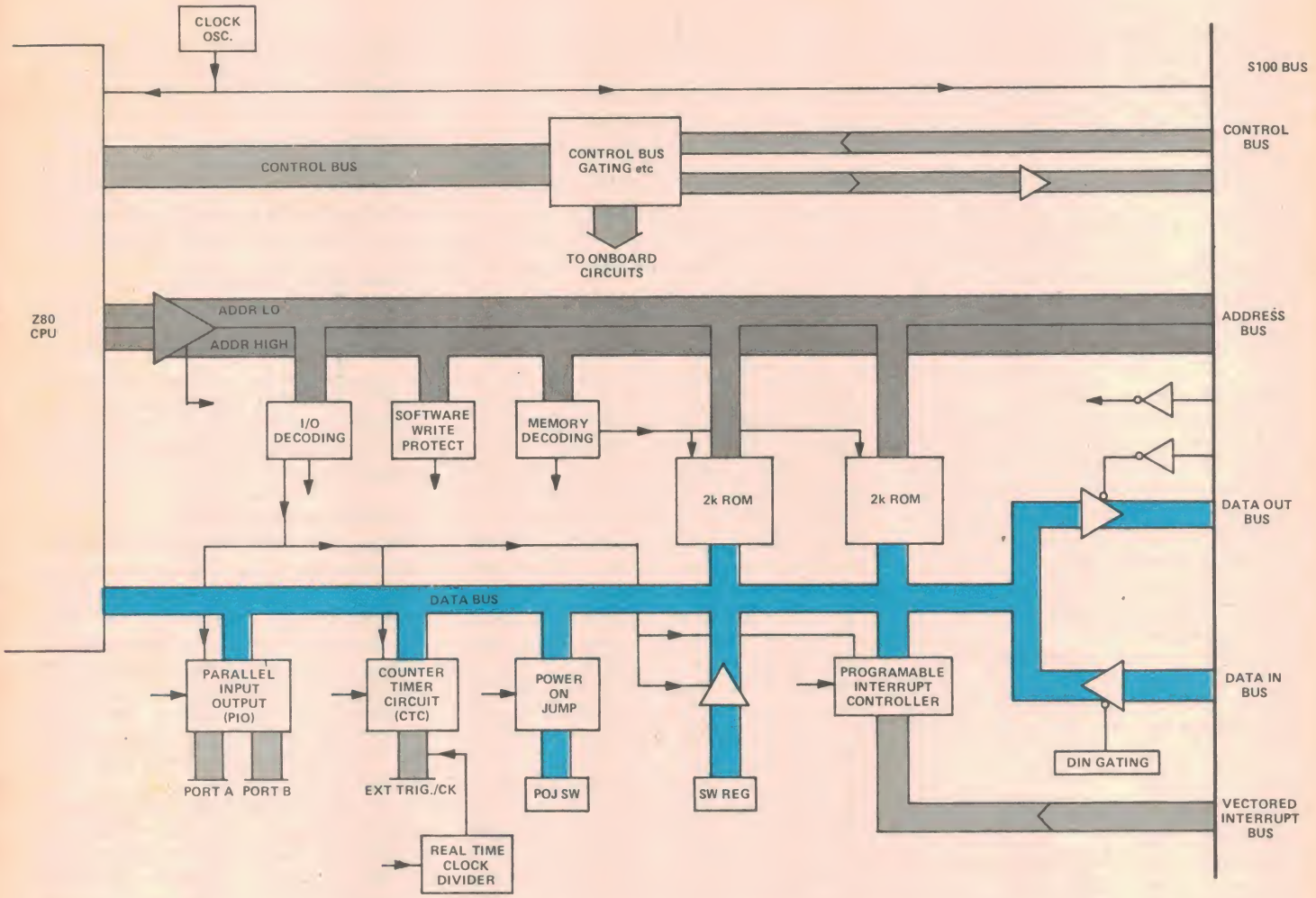
Software write protect

Provision is made to inhibit writing to any memory within the entire memory map, under program control. Some memory boards already have provision for write protecting on them, however this is usually done in large segments and it may not be convenient to protect a whole segment. Having the write protect facility on the CPU board allows the flexibility of protecting any memory in the system.

In conjunction with the programmable interrupt controller (PIC) it is possible to cause an interrupt if any attempt is made to violate the write protection. This can be used to trap program walks.

SPECIFICATIONS ETI 680 (DGZ80) S100 CPU BOARD

* Standard S100 board (5" x 10").
* S100 bus compatible.
* Z80/Z80A CPU.
* Z80 PIO chip provides two fully programmable 8-bit ports (in, out or control/bit mode).
* 8-bit unlatched parallel port for switch register, etc.
* Z80 CTC chip provides four programmable counter/timer channels.
* Real time clock (RTC) using one CTC channel gives programmable interrupt rate to the processor.
* Programmable interrupt controller (PIC) chip allows other S100 boards to utilize the powerful Z80 vectored interrupt mode.
* Power on jump (POJ) permits program execution to commence at any 100 H boundary.
* Soft write protect (SWP) permits write protection of any 100 H block of memory.
* On board ROM – 2K EPROM for monitor program.
* On board RAM – 2K RAM for stack, scratchpads, etc.
* LED indicators on HALT acknowledge
  BUS REQUEST acknowledge
  On-board memory accessed.
* 2 MHz/4 MHz operation. Provision made to change clock frequency.
* Single +8 V supply required if a single supply 2716 ROM is used.



PARTS LIST - ETI 680

Resistors all ¼W, 5%
- R1–R3 . . . . 330R
- R4–R12 . . . . 4k7
- R13 . . . . . 47k
- R14 . . . . . 4k7
- R15, R16 . . . 10k
- R17 . . . . . 4k7
- R18 . . . . . 150R
- R19 . . . . . 330R

Capacitors
- C1, C2 . . . . 22µ tantalum
- C3 . . . . . 1µ tantalum
- C4 . . . . . 22p ceramic
- C5 . . . . . 82p ceramic
- C6–C16 . . . . 10n ceramic
- C17 . . . . . 6–26p trimmer
- C18, C19 . . . . 10n ceramic

Semiconductors
- D1–D7 . . . . IN914
- LED1 . . . . . Red 2mm LED
- LED2 . . . . . Green 2mm LED
- LED3 . . . . . Orange 2mm LED

Integrated Circuits
- IC1 . . . . . 74LS74
- IC2,6,9,37 . . . 74LS00
- IC3, 34 . . . . 74LS02
- IC4 . . . . . 74LS14
- IC5, 8 . . . . . 74LS90
- IC7 . . . . . 74LS30
- IC10, 15 . . . . 74LS367
- IC11, 35 . . . . 74LS04
- IC12 . . . . . Am9519 (PIC)
- IC13,20,24, 31, 32 . . . . 81LS97
- IC14 . . . . . 82S123 or Harris 7602
- IC16 . . . . . 74LS368
- IC17 . . . . . 74LS125
- IC18 . . . . . 74LS10
- IC19 . . . . . Z80CPU 4 MHz or 2 MHz
- IC21, 25 8131
- IC22, 38 . . . . 74LS139
- IC23 . . . . . 2516 (TMS) or 2716 (INTEL)
- IC26 . . . . . 74S200
- IC27–30 . . . . 2114 RAM
- IC33, 36 . . . . 74LS257
- IC34 . . . . . Z80 PIO
- IC40 . . . . . Z80 CTC
- IC41 7404
- IC42 . . . . . HEF 4020
- IC43 . . . . . 74LS93
- IC44 . . . . . LM309K or 7805

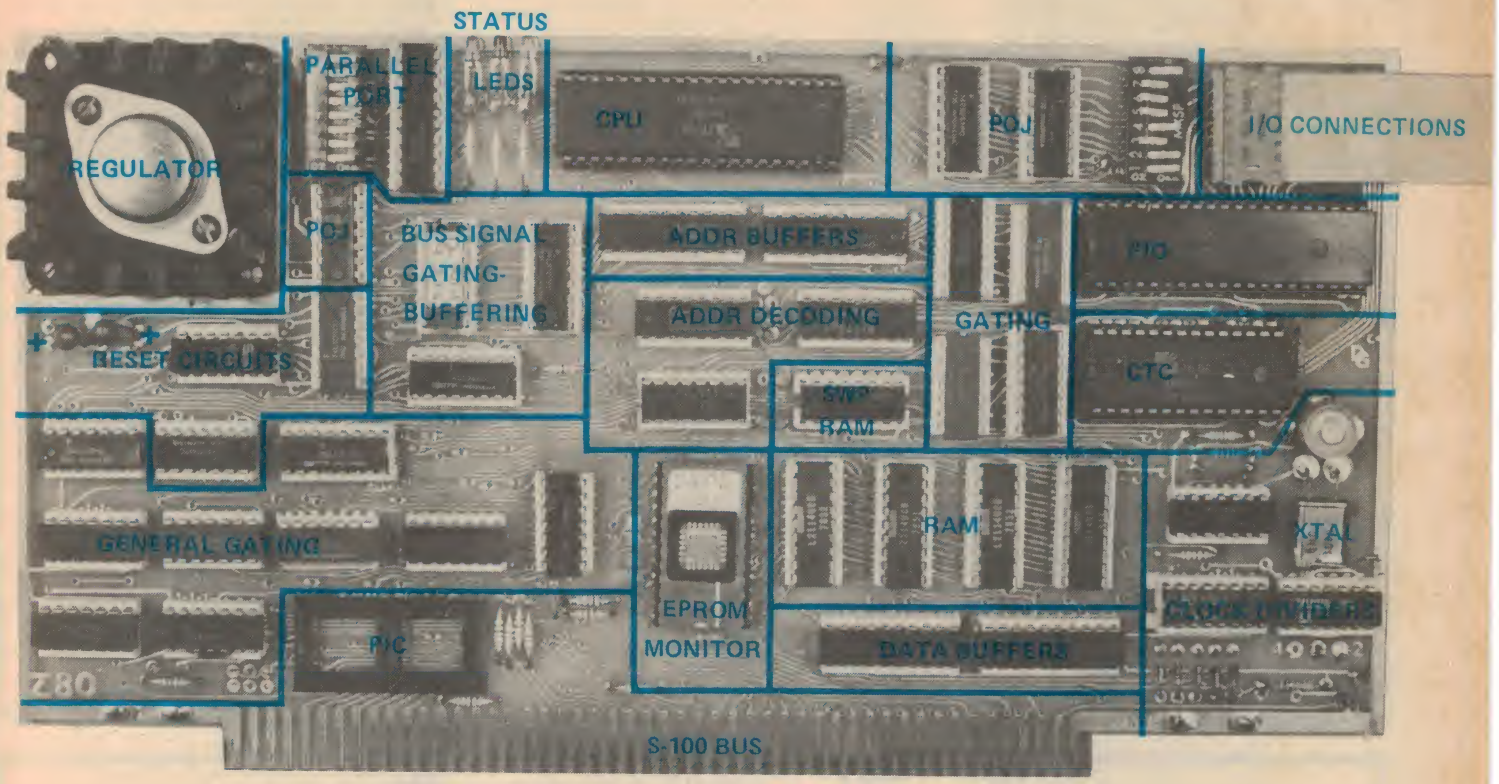
NOTE: IMPORTANT – Substitution is not recommended in any components.

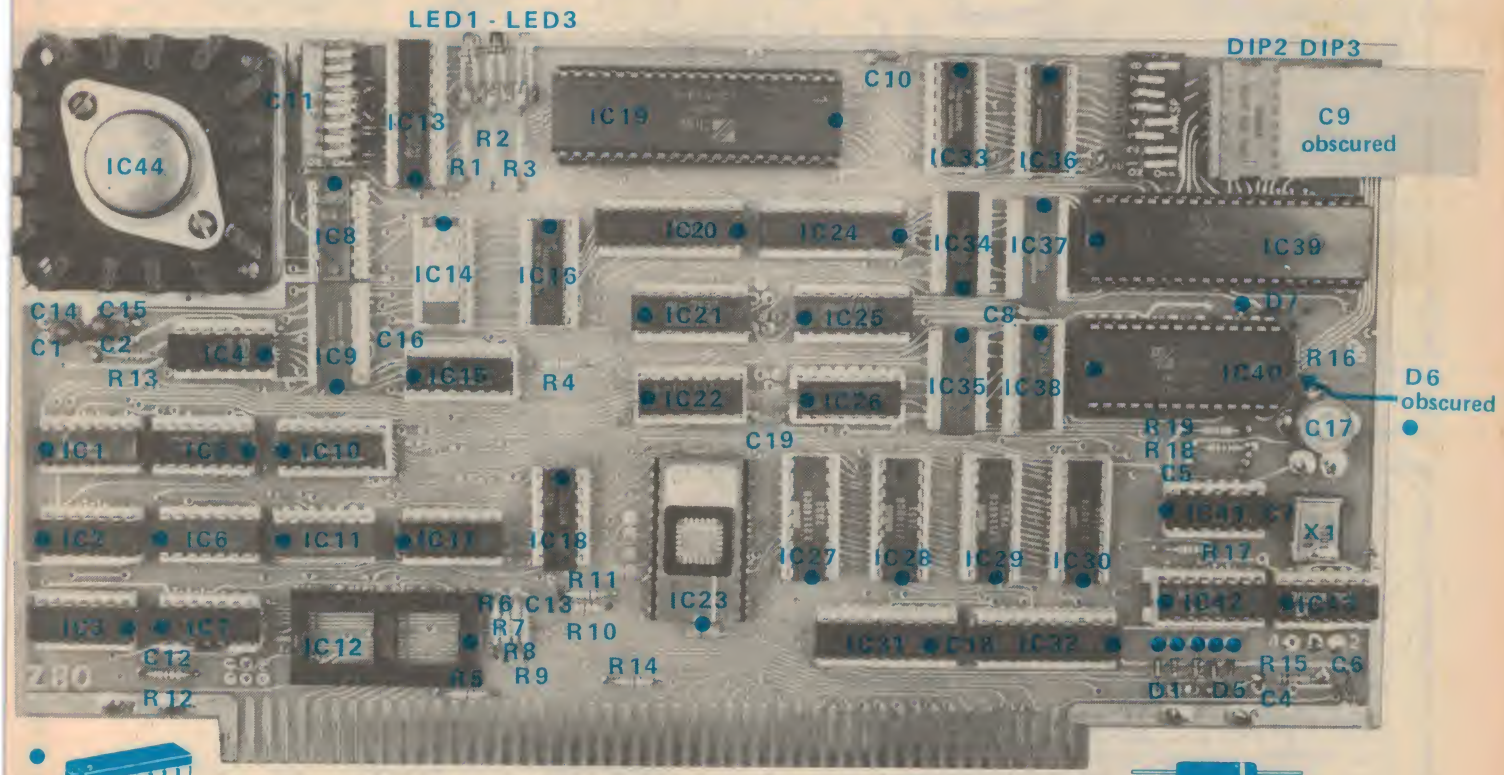
IC Sockets

Quantity	Size
2	40 pin
2	28 pin
1	24 pin
5	20 pin
4	18 pin
15	16 pin
17	14 pin

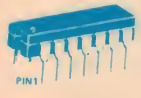
Miscellaneous
- DIP1–DIP3 . . 16 pin IC sockets
- X1 . . . . . 8 MHz crystal, HC18 package

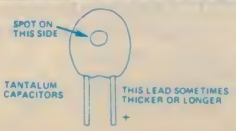
Heatsink to suit regulator IC, ETI/DG 680 pc board, 8-pole DIP switch.

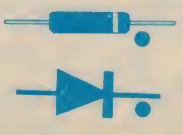




C3 mounted underneath regulator from output terminal to earth.







THE PROCESSOR

The Zilog Z80 microprocessor is one of the latest of the 8-bit micros. Increased data handling capacity and more efficient use of the available memory compared to other devices are the two major features of the device. These features, coupled with single supply requirements and on-chip output decoding and timing, make it a very easy processor to design into a system.

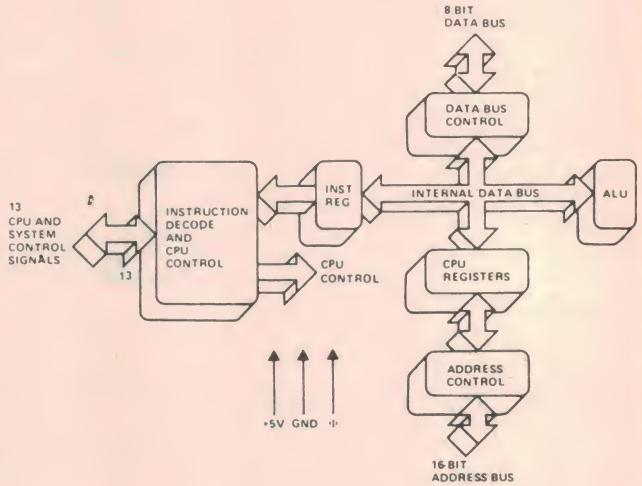
The block diagram of the CPU is at right.

The internal register configuration contains 208 bits of read/write memory that are accessible to the programmer. The registers include two sets of six general purpose registers that may be used individually as 8-bit registers or as 16-bit register pairs.

There are also two sets of accumulator and flag registers. The programmer has access to either set of main or alternate registers through a group of exchange instructions. This alternate set allows foreground/background mode of operation or may be reserved for very fast Interrupt response.

The CPU also contains a 16-bit stack pointer which permits simple implementation of multiple level interrupt, unlimited subroutine nesting and simplification of many types of data handling.

The two 16-bit index registers allow tabular data manipulation and easy implementation of relocatable code. The Refresh register provides for automatic, totally transparent refresh of external dynamic memories. The I register is used in a powerful interrupt response mode to form the upper weight bits of a pointer to an interrupt service address table, while the interrupting device supplies the lower eight bits of the pointer. An indirect call is then made to this service address.



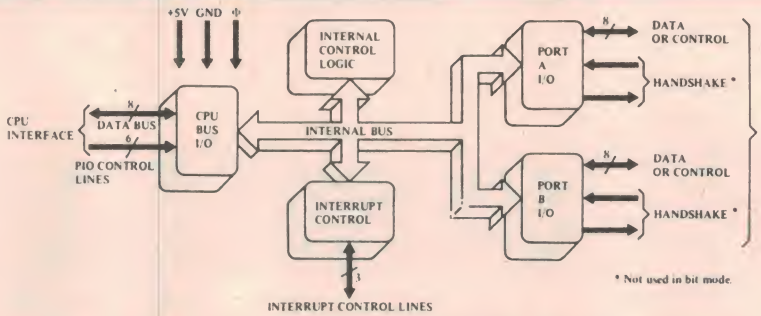
PARALLEL INPUT OUTPUT CHIP – Z80-PIO

The parallel input output chip interfaces with the various peripheral devices, keyboards, VDUs and the like to allow information flow from these devices to the Z80 CPU.

The internal structure of the Z80-PIO consists of a Z80-CPU bus interface, internal control logic. Port A I/O logic, Port B I/O logic, and interrupt control logic. The CPU bus interface logic allows the PIO to interface directly to the Z80-CPU with no other external logic. However, address decoders and/or line buffers may be required for large systems.

The internal control logic synchronizes the CPU data bus to the peripheral device interfaces (Port A and Port B). The two I/O ports (A and B) are virtually identical and are used to interface directly to peripheral devices.

The Port I/O logic is composed of six registers with "handshake" control logic as shown. The registers include: an 8-bit data input register, an 8-bit data output register, a 2-bit mode control register, an 8-bit mask register, an 8-bit input/output select register, and a 2-bit mask control register.



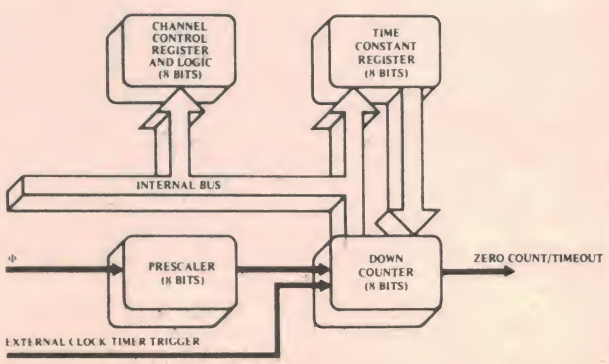
COUNTER-TIMER Z80-CTC

The counter timer chip is a programmable four channel device that provides counting and timing functions for the Z80 CPU. The CPU configures the four CTC channels to provide different functions as required.

The internal structure of the Z80-CTC consists of a Z80-CPU bus interface, Internal Control Logic, four sets of Counter/Timer Channel Logic, and Interrupt Control Logic.

The four independent counter/timer channels are identified by sequential numbers from 0 to 3. The CTC has the capability of generating a unique interrupt vector for each separate channel (for automatic vectoring to an interrupt service routine).

The four channels can be connected into four contiguous slots in the standard Z80 priority chain with channel number 0 having the highest priority. The CPU bus interface logic allows the CTC device to interface directly to the CPU with no other external logic. However, port address decoders and/or line buffers may be required for large systems.



Programmable Interrupt Controller

The CPU board is designed to work in conjunction with the Z80's powerful interrupt mode 2. This mode permits fast handling of multiple interrupts by requiring each interrupting device (usually an I/O port) to respond with a vector identifying itself 'upon receipt of an interrupt acknowledge signal'.

All chips in the Z80 family have provision to make this response. However, to facilitate using boards which do not have such provision, there is an interrupt controller chip that can respond on behalf of an external (to the CPU board) interrupt.

Because this facility is only likely to be required when the system is expanded, (and even then, not if Z80 chips are used) this PIC chip need not be included on the basic board.

Control signal gating

The necessary gating to derive the control signals on the board and for the S100 bus is done by a fusible link 32 byte PROM. Using a PROM for this function reduces the chip count.

DGOS monitor program

DGOS (DG Operating System) is a monitor program that has been written specifically for use with the DG Z80 CPU Board and is intended to be run in the on-board ROM. An alternate program can be substituted if you desire to use the board for a dedicated application or write your own monitor program.

DGOS is written to run in conjunction with a DG 640 VDU.

DGOS is written to provide control over the special facilities of the CPU board, as well as providing all the usual requirements of a machine code monitor/debugging tool.

The basic functions provided are:

* Examine contents of memory (in hexadecimal).
* Modify contents of memory (in hexadecimal).
* Execute a program from a given addr.
* Read a tape file (program or data) into memory.
* Write a tape file.

In addition to these basic functions there are several commands that facilitate program debugging and modification:

* Move a block of memory (starting from the top or bottom).
* Fill a block of memory (with any value).
* Compare two blocks of memory.
* Search for a character string (1-6 char's).

And command for control of hardware facilities:

* Protect a block of memory.
* Unprotect a block of memory.
* Set 'Time of Day'.

Monitor program

The Monitor Program is contained within a read only memory (ROM) which is plugged into the board. This program tells the computer how to communicate with all the things which may be connected to it such as VDU or cassette unit, and the order which things must be done for the correct operation of the system.

Monitor programs vary from system to system depending on the facilities needed and are always very lengthy. For this reason we have not presented the Monitor Program here but the Monitor designed for this system is available commercially as a plug-in chip.

Alternatively, any Z80 monitor will do equally well or perhaps you will want to 'blow your own'. See Shoparound for the availability of pre-programmed Monitor ROMs.

The printed circuit board is a double-sided type with plated-through holes as the circuitry is very complex. For two reasons, we have not been able to reproduce the artwork here. Firstly, to do so would require a considerable amount of space and secondly, there would not be a great number of readers able to reproduce a pc board of this size and complexity. However, for those hardy souls with enough tenacity, patience and equipment to do the job, a high quality copy of the artwork can be obtained from the magazine by sending a large, stamped, self-addressed envelope to:

ETI 680 pc artwork
Electronics Today Magazine
15 Boundary St.
RUSHCUTTERS BAY 2011 NSW

The copyright on the pc board design is held by David Griffiths/Microworld. Any companies wishing to reproduce the board themselves should contact David Griffiths direct (P.O. Box 248 Baulkham Hills NSW 2153).

We understand David has made arrangements for high quality, fibre-glass substrate pc boards to be available at trade prices through Applied Technology.

Intending constructors can obtain boards through a number of retail outlets, details are given in Shoparound.

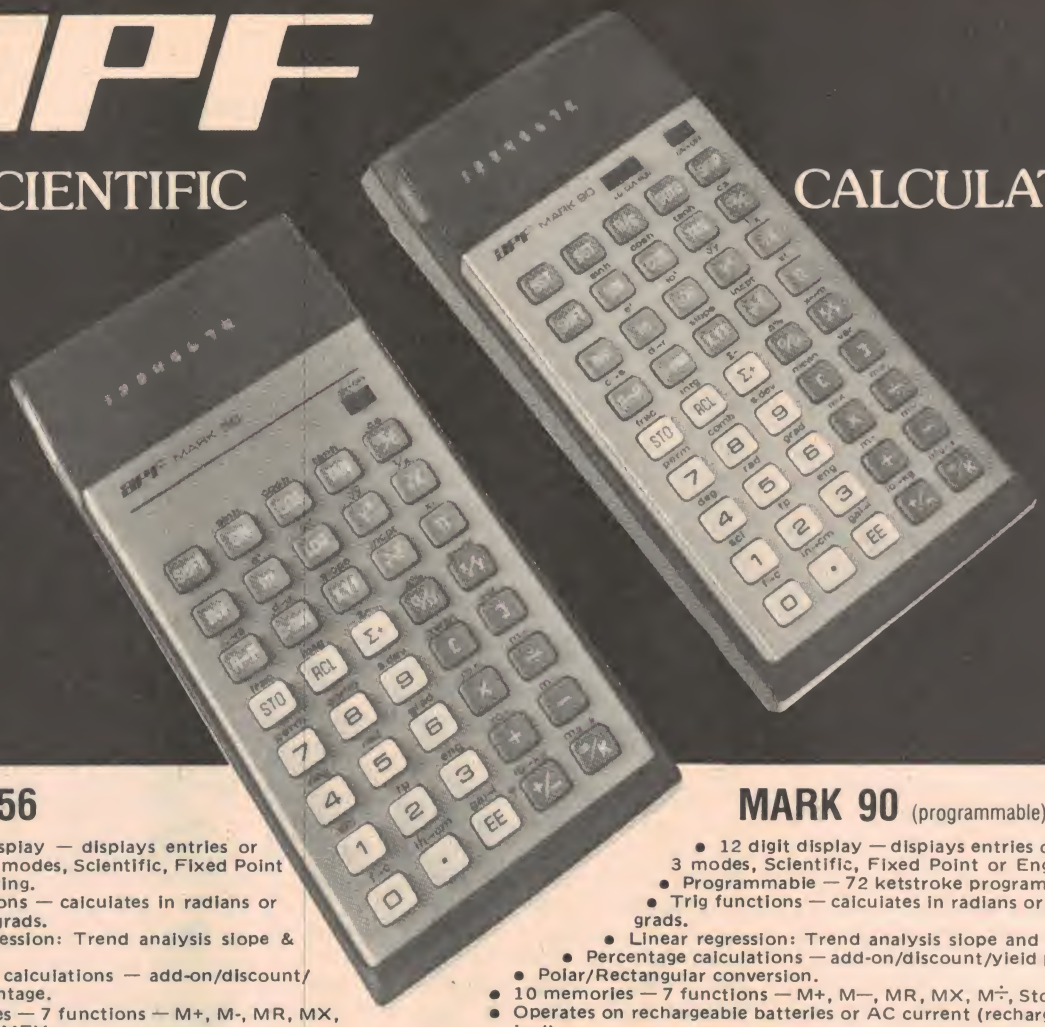
REFERENCES

Zilog Z80/Z80A CPU Technical Manual
Zilog Z80/Z80A PIO Technical Manual
Zilog Z80/Z80A CTC Technical Manual
Zilog Application Note 'Z80 Family Program Interrupt Structure'
Zilog Z80 Assembly Language Programming Manual
Mostek Z80 CPU Technical Manual
AMD AM9519 Universal Interrupt Controller
— Prelim Information
— Application note
Intel Component Data Catalog 1978

The Zilog references are available through Zilog's Australian agent — ZAPS. □ Z80 is a trademark of Zilog. ●

APF

SCIENTIFIC CALCULATORS



MARK 56

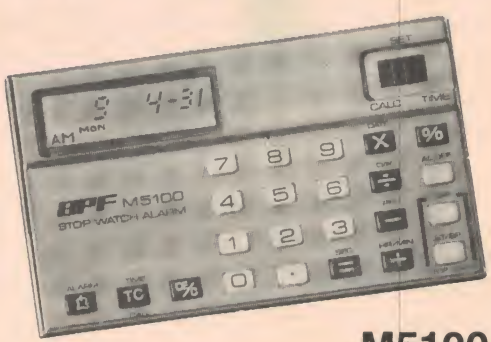
- 12 digit display — displays entries or results in 3 modes, Scientific, Fixed Point or Engineering.
- Trig functions — calculates in radians or degrees or grads.
- Linear regression: Trend analysis slope & intercept.
- Percentage calculations — add-on/discount/yield percentage.
- 10 memories — 7 functions — M+, M-, MR, MX, M÷, Store, MEX.
- 8 metric conversions.
- Operates on rechargeable batteries or AC current (recharger/adaptor incl).
- Dimensions — L 6" x H 1 1/8" x W 3".

$49.95 incl. tax

MARK 90 (programmable)

- 12 digit display — displays entries or results in 3 modes, Scientific, Fixed Point or Engineering.
- Programmable — 72 ketstroke program storage.
- Trig functions — calculates in radians or degrees or grads.
- Linear regression: Trend analysis slope and intercept.
- Percentage calculations — add-on/discount/yield percentage.
- Polar/Rectangular conversion.
- 10 memories — 7 functions — M+, M—, MR, MX, M÷, Store, MEX.
- Operates on rechargeable batteries or AC current (recharger/adaptor incl).
- Dimensions — L 6" x H 1 1/8" x W 3".

incl. tax **$65**



M5100

- LCD Calculator, Clock/Alarm Stop Watch
- 8 digit liquid crystal display
- Floating decimal point
- Fully addressable 3-key memory
- Percent key
- Shows time, day, date, AM-PM on display
- Alarm can be set for any hour and minute of the day
- Stop watch, lap counter, displays hours, minutes seconds and tenth of a second up to 9-59-59.9
- Battery life approximately 10,000 hours
- Includes batteries, simulated wallet-type case, instruction book
- Dimensions 3 9/16" L x 3/16" H x 2 1/8" W.

$32.95 incl. tax

8601 $39.95 incl. tax

- Advanced LCD scientific calculator
- 10 digit with sign or 8 digit mantissa + 2 digit exponent display
- 1 independent memory
- Calculation range: 10^{-106} ~ 10^{107}
- Mode key for Degree/Radian/Grad/Statistical function selection
- Two level parenthesis
- Scientific functions: x^2, $\sqrt{x}$, 16x, π, x!, 10^x, e^x, ln, log, y^x, $x\sqrt{y}$, nPr, nCr, sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$, n, $\bar{x}$, Σx, Σx, P(x), Q(x), R(x), *Exchange functions: CN, P→R, R→P, o' "→, → o' ", D→R, R→G, G→D, R→D, G→R, D→G,
- Long battery life — over 2000 hours operation
- Super thin size with deluxe aluminium case

Available from: **Johansen Systems P/L**, c/- Isa Plaza Realty, K-Mart Plaza, Mt Isa, Qld. 4825. **Caleb's Calculators**, 117 Bayliss St, Shop 5, Neslo Arcade, Wagga Wagga. **Radio Parts Group**, 562 Spencer St, Nth Melbourne, 1103 Dandenong Rd, East Malvern, Vic. **DCL Surveying Instruments P/L**, 52 Hughes St, Mile End, Adelaide. **Calculator Supermarket**, 435 Bourke St, Melbourne.

Trade enquiries only:
Electrocount Pty. Ltd. 67-6412.

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ETI SERIES 4000 (TWIN 60W)

Described in a series of articles starting ETI May, 1979, this top performing amplifier uses the latest **Darlington Output Transistors** and produces 60W per channel into 8 Ohm. A professional quality case with timber side panels and prepunched silk screened front panel will match any "off the shelf" Hi Fi gear.

Our repair service is available on this kit.

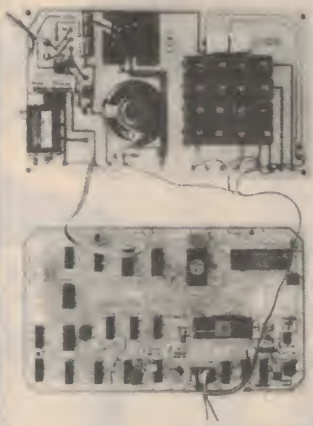
SPECIFICATIONS ETI 470

Power Output . . . . . 60 watts into 8 Ohms (±40V supply).
Frequency Response . . . . . 10 Hz TO 100 KHz ± .5 dB.
Input Sensitivity . . . . . 500 mV rms per 60w output.
Hum and Noise . . . . . better than -110 dB.
Feedback Ratio . . . . . better than -110 35 dB.
Distortion . . . . . Closed Loop 0.04%.

* ETI 470 60W module (2 req) . . . . . **$29.50 each.**
ETI 470 PREAMP KIT (1 req) . . . . . **$47.50.**
4000 Series Case—timber sides, silk screen, front panel . . . . . **$45.00 (F).**

Complete Kit . . . down to the last bolt, includes 2 x 470 kit, 1 x 471 kit, 1 x power supply, 4000 case with timber sides, silk screened prepunched front panel, knobs, sockets etc. Also includes our detailed step by step assembly manual **$179.50 (F).**

HAVE FUN WHILE LEARNING ABOUT MICRO COMPUTERS



Learn as you build this fascinating microprocessor project designed by Michael Bauer and published in Electronics Australia May, 1979.

We have redesigned the PCB to use the latest 6802 chip which has a self-contained clock driver (eliminates 6875 supply problem) and is fully 6800 compatible. A separate PCB is supplied containing an 18 key keyboard, power supply and modulator.

All components are supplied including top quality fibreglass PCB, keyboard, modulator CHIPOS in 2708 EPROM, 6802 with full data sheets. Also included is a detailed operator's manual with construction notes, data sheets and exciting programs for you to run.

SPECIFICATIONS

CPU . . . . . 6802.
CLOCK . . . . . 4 MHz XTAL.
RAM . . . . . 1K x 8 on card (31K expansion off card).
ROM . . . . . CHIPOS 1K x 8 in EPROM.
DISPLAY . . . . . 64 x 32 DOT MATRIX.
VIDEO OUTPUT . . . . 75 OHm. 1V p-p OR RF Modulator at Channel O.

INPUT/OUTPUT . . . 6821 CONTROLS

- Hex Keypad Plus Function, Reset Keys.
- Tape 300 Baud Cassette Interface.
- Real Time Clock.
- Audio Bleeper.
- Display/DMA Control Line.

DREAM 6802 COMPLETE KIT . . . . . $149.50.

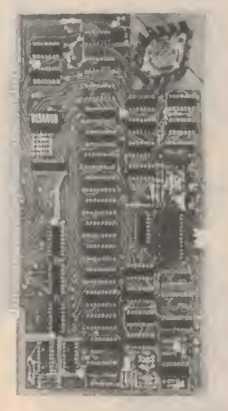
AT LAST DESIGNED BY DAVID GRIFFITHS FOR S100 BUS. DG Z80

This has to be one of the most powerful Z80, S100 cards yet produced in the world to date. Designed by David Griffiths exclusively for Applied Technology, the DG Z80 is packed with a host of features, including:

- ★ S100 board.
- ★ Z80 CPU.
- ★ Z80—provides 2 parallel ports fully programmable for input/output or control mode.
- ★ Z80 CTC—provides 4 fully programmable counter/timer channels. One channel serves as a REAL TIME CLOCK.
- ★ SOFTWARE WRITE PROJECT—allows write protection of all memory in 100 HEX byte increments.
- ★ 8 BIT SWITCH REGISTER—DIP SWITCH that can be read by the processor.
- ★ REAL TIME CLOCK ON BOARD.
- ★ ON BOARD ROM provision for 2K bytes of resident monitor (in 2716) for immediate operation.
- ★ ON BOARD RAM provision for 2K bytes for scratch pad, stack etc.
- ★ POWER ON JUMP to any 100 HEX boundary on reset.

DG Z80 BASIC KIT **$195.25**
(Tax Exempt . . . **$175.00**)
DGOS MONITOR ROM **$48.00**
ASSEMBLED/TESTED **$240.00**
(Tax Exempt . . . **$215.00**)

S100 VDU — DG640



An ideal support for the DG Z80, this S100 VDU was described in ETI March 1978 and has now become popular in Europe. Designed by David Griffiths, the DG 640 features:

- ★ 16 lines of 64 characters.
- ★ Upper/lower case.
- ★ "CHUNKY" graphics.
- ★ Crystal locked, self contained TV scan control circuitry.
- ★ Top quality plated through PCB with solder mask.
- ★ Sockets for all IC's.
- ★ S100 edge connector.
- ★ Detailed assembly manual with support software for 2650, SC/MP, Z80, 8080 and 6800.

DG 640 KIT **$139.50**
($125.70 Tax Exempt)
A/T **$149.50**
($134.85 Tax Exempt)

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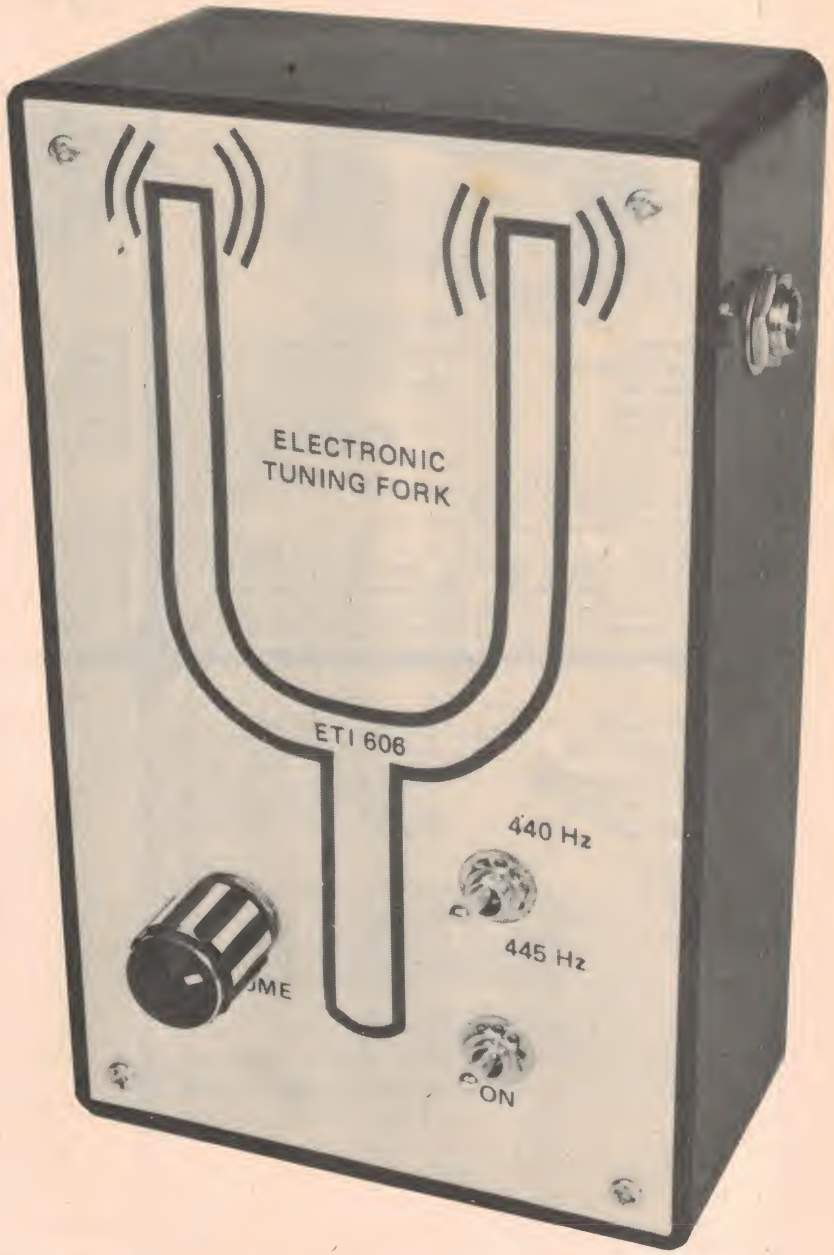
NOTE: (1) Items marked (F) will be sent freight forward (at your expense) . . . On other items please add $2.00 per order towards packing/postage.

NOTE: (2) Prices shown are TAX PAID. Tax exemption institutions must include official Certificate with the order.

An electronic 'tuning fork'

Design **Phil Cohen**

Article **Staff**



BRIEF HISTORY OF THE TUNING FORK

According to "The Oxford Companion to Music", the tuning fork (or pitch fork as it was called, and we shall soon see why) was invented in 1711 by a British gentleman called John Shore who was Sergeant Trumpeter to the court and lutenist in the Chapel Royal. Though famous for his trumpet playing (Handel and Purcell composed works for him), it was in his capacity as lutenist that he came to invent the tuning fork. Handel's tuning fork was made by Shore, and it still exists.

John Shore was clearly something of a 'character' for he introduced the new 'pitch fork' with a pun:

"I have not about me a pitch pipe, but I have what will do as well to tune by, a pitch fork", which he would trot out at concerts where he played the lute.

It was a mid-19th century scientist, Rudolph Koenig, of Paris, who refined the pitch fork to that general form which is commonly used today.

MUSICAL INSTRUMENTS are generally a clever and harmonious blend of physics and aesthetics (both aural and visual). But, underlying all this wonderful harmony and human cleverness is the law of 'the cussedness of nature'. This law, simply explained, says that through all the consistency and harmony we find in nature runs a streak of cussedness always causing *something* to be out of place. It is this very streak of cussedness that has thwarted attempts to date to develop a 'unified field' theory that would link gravity, electricity and magnetism.

It doesn't seem, at this stage, that gravity, electricity and magnetism have much to do with musical instruments and tuning forks, but we'll get around to it!

For one musical instrument to be played with another requires both to be tuned to the same fundamental pitch (or frequency). If not, the sound will be unpleasant — generally described as discordant.

Over the centuries there were various ideas as to what basic 'standard' pitch would be adopted. After some considerable squabbling a 'standard concert pitch' was settled upon in 1929. This gave the note 'A' a pitch of 440 Hz. That standard remains to this day. Of course, it means that modern orchestras playing the music of Hadyn, Mozart and Bach, for example, will not be playing in the pitch in which the music was originally composed.

Another, perhaps more graphic, example occurs in recordings made by modern pop groups of old 'blues' masters. In the days when many of these 'race' records were being cut in America — direct to disc, too! — many

musicians, particularly guitarists, played in widely varying pitches. A comparison between The Beatles' recording of "Matchbox Blues" and those made some 30 or more years earlier by Leadbelly and Blind Lemon Jefferson reveals a remarkably wide variation. Leadbelly tuned his 12-string guitar 'low', Blind Lemon Jefferson tuned his six-string guitar 'high' and The Beatles played in 'British Standard Concert Pitch'.

There are few musical instruments which will retain their tuning for any appreciable length of time. All of the portable stringed instruments (guitars, banjos, mandolins, violins, cellos ad infinitum) are particularly prone to drifting strings. Wind instruments also suffer – you have to take them apart to carry them and they must be tuned when re-assembled for playing.

See what we mean about the cussedness of nature ?

This problem gave rise to the need for some device which would serve as an accurate standard to which instruments could be tuned. Even the piano and oboe – which are generally used as tuning references in an orchestra – must be tuned from time to time.

In 'olden times' pitch-pipes were employed as pitch standards. These were simple wooden "whistles" of the open pipe or vibrating reed variety. These little 'fixed pitch' devices, whilst simple and portable, suffered from pitch inaccuracies brought about by changes in air temperature and humidity. However, they're still in use as they're fine where no great pitch accuracy or adherence to a standard is required. The 'tuning fork' as such was invented by John Shore in Britain in 1711 (see note on history).

The traditional tuning fork consists of two cantilevered bars attached to a common base – it resembles that common eating utensil, hence the name. When the tines are struck (or one tine) they will vibrate, producing a sound of a definite pitch, or frequency, determined by the length of the tines. The pitch is largely unaffected by temperature, except by gross variations, and accuracy can be maintained within about 0.1%.

They are portable and relatively inexpensive but suffer from low sound level output and do not give a sustained note – it 'dies away'. What's more, as many modern groups use electrically amplified instruments and sound reinforcement, a failing of tuning forks is lack of a pick-up.

Again, the cussedness of nature raises its head. Remember too, the popularity of the electric guitar. They have magnetic pickups and require plugging into an amplifier. Now you see what electricity and magnetism have to do with musical instruments ! Gravity ? Oh, most instruments will go out of tune when dropped from a height !

HOW IT WORKS – ETI 606

The signal is generated at a high frequency (about 3.6 MHz) by a crystal oscillator and then divided down to the output frequency by a counting circuit. IC1c is the oscillator – gates biased into their linear region by R1 and R2. Capacitor C1 forms a phase-shift network with the bias components, providing a shift of 180 degrees at the crystal frequency. As the crystal is in series with the feedback path, the circuit will oscillate at the crystal frequency.

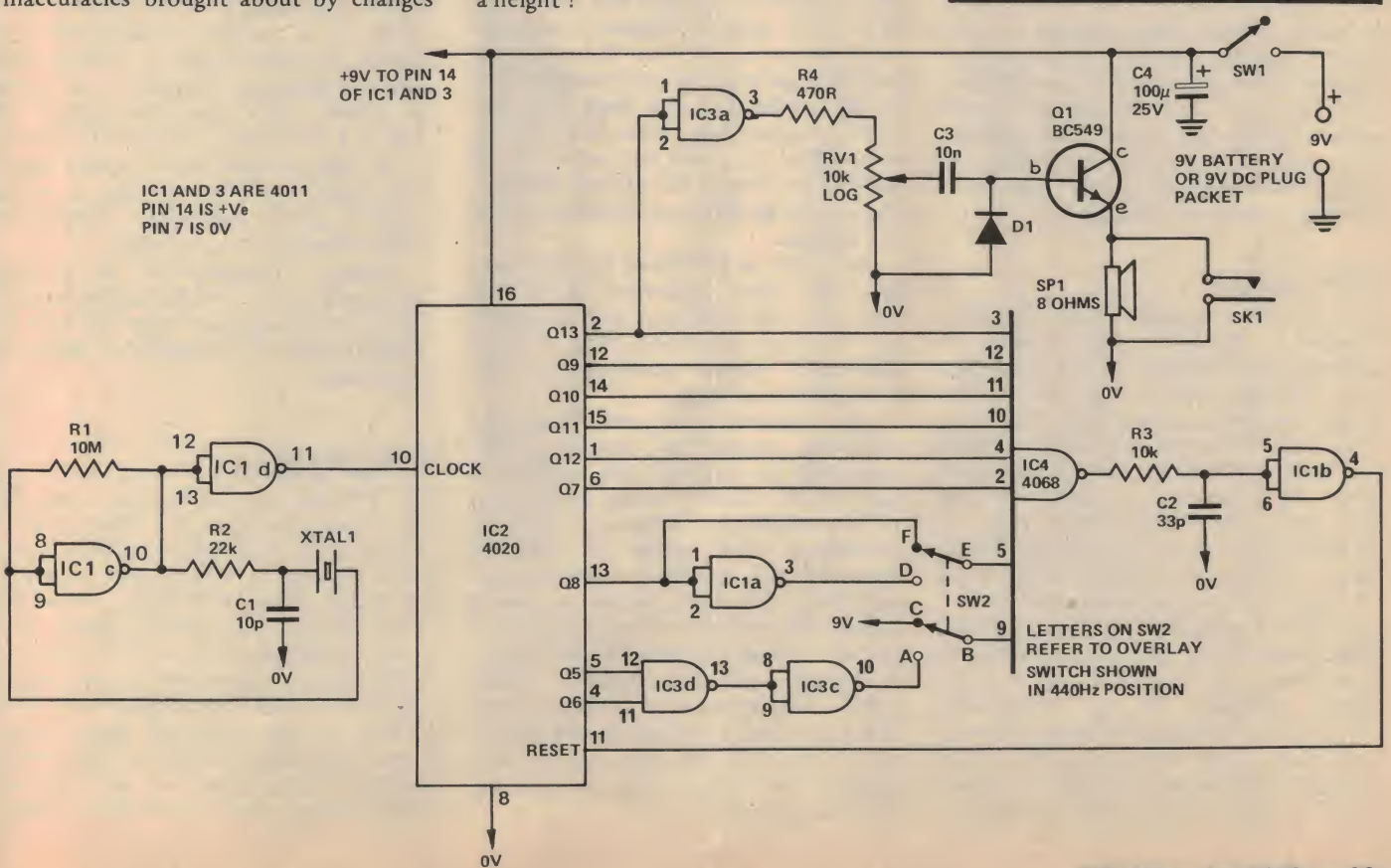
IC1d forms a buffer between the oscillator and the clock input of IC2, a 14-stage counter.

As the required division is not a power of two, decoding of the counter (IC2) outputs is necessary. This is provided in three gates – IC1a, IC3c and IC3d. These modify the outputs of IC2 to obtain the required division by resetting IC2 after the appropriate count.

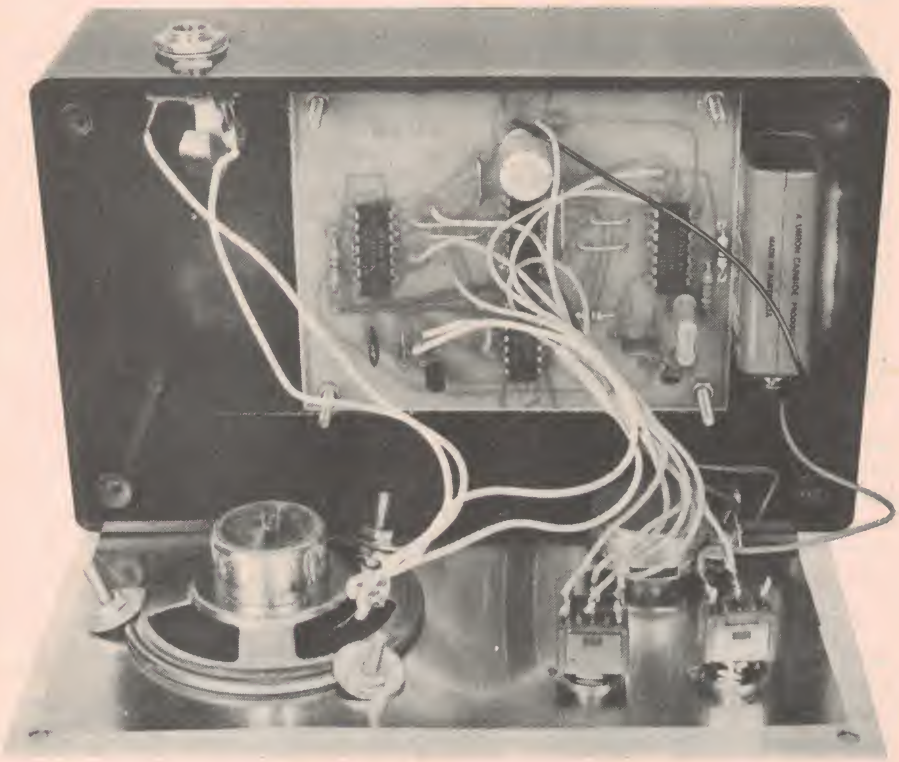
Switch SW2 changes the decoding for either a division by 8128 for a 440 Hz output or 8048 for a 445 Hz output.

When all the inputs of IC4, an eight input NOR gate, go high its output goes low and drives IC1b via a network to remove noise pulses (R3, C2). IC1d then provides a reset signal to the divider, ready for the next count.

The Q13 output from the divider provides a signal at the required frequency and, after buffering provided by IC3a is fed to the volume control. The pulses are then fed to an emitter follower (Q1) and thence to the speaker.



Project 606



Demand for an 'electronic' tuning fork arose in recent years, seemingly as a result of the rapid increase in 'all-electric' bands. A number of commercial models have appeared but it seems that the perennial 'do-it-yourselfers' would rather build their own. Some readers have enquired about the possibility of doing an electronic tuning fork as a project — and here you have it.

The design

The problem appears fairly straightforward — synthesize 440 Hz with an accuracy and stability of 0.1% or better. First thought was to use the 50 Hz mains frequency as a reference (as it is very stable in frequency) and phase-lock an oscillator to it. This was tried using a 3900 quad op-amp as oscillator and PLL and some CMOS divider chips — five ICs in all. It worked, but the device had a number of practical drawbacks.

First up, 50 Hz mains had to be available. A musician friend pointed out that, here, we had made an unwarranted assumption. In the words of a well-known prophet: "It ain't necessarily so!". On top of that, the editor pointed out that many musicians who play stringed instruments prefer to tune about 3 Hz to 5 Hz high (or 'sharp') as it makes their instruments sound much 'brighter'. We had also heard that there were some orchestras tuning up using 'A' set at 445 Hz. This started a furious argument. As everything started to get confused at this stage and text-book consultations threw less light on the subject than was felt desirable, we decided to contact the Sydney Conservatorium of Music in an effort to resolve the dispute.

We spoke to Mr Trevor Faulcher who said that some orchestras in Sweden were using 445 Hz as a standard pitch for 'A' and confirmed that stringed instrument players preferred to tune a little sharp in pitch.

The problem now was, should the electronic tuning fork project include both 440 Hz and 445 Hz outputs or just 440 Hz alone? As the project was to be portable and battery operated the techniques that might be used to generate the required output were examined. The best bet was to use a commonly available quartz crystal and divide it down to give a 440 Hz output. A slightly different division should yield a 445 Hz output. A quick check indicated such a scheme would require fewer ICs than the PLL version first devised and that both frequencies could be provided.

As the project was to be battery operated, it was clear that CMOS ICs would be necessary in the circuit and this imposed a limit on the frequency of the crystal of about 5 MHz.

There are two very common crystals available from many outlets: one on 4.433619 MHz which is the PAL colour TV system chrominance sub-carrier frequency, and 3.579545 MHz which is the NTSC system chrominance sub-carrier frequency. (We couldn't find out why the latter is common here — but, there it is!) We chose the lower frequency of the two for several reasons. Firstly, 4.4 MHz is pushing the limit of CMOS if repeatable results were to be obtained by constructors. Secondly, it was the cheaper of the two!

Obtaining 440 Hz from such a high frequency requires dividing by a very large number. To get 440 Hz requires dividing by about 8130 while 445 Hz requires dividing by about 8050.

Accordingly, a 4020 CMOS divider was settled upon. This will provide a division ratio as high as 2^{14}. By suitably decoding the various outputs from the divider and resetting it when the appropriate count is reached, the output will be at (or close to) the frequency we want.

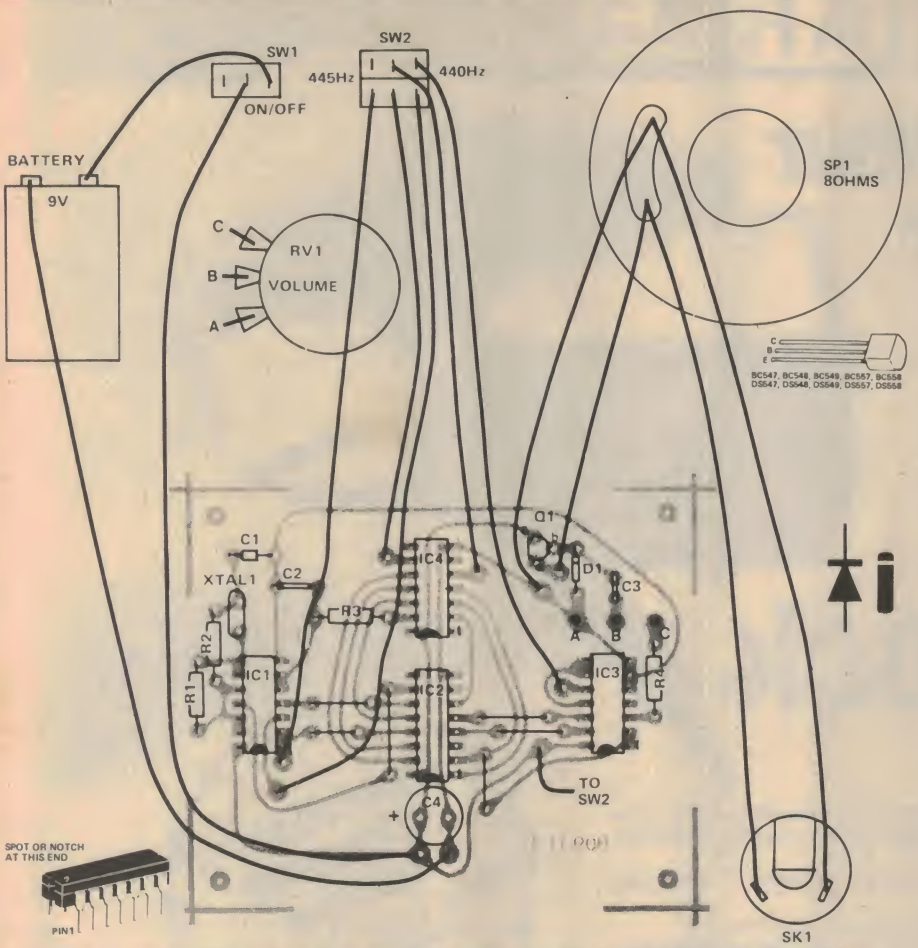
Thus, the outputs of the 4020 are decoded at a count of 8128 — conveniently close to 8130 — producing an output of 440.396 Hz. That's only 0.09% high. This is within the tolerance range of a standard tuning fork. To obtain an output close to 445 Hz, the 4020 outputs are decoded at a count of 8048, producing an output of 444.775 Hz which is only 0.05% low.

A fairly simple audio output stage has been provided, driving a small speaker, and a jack socket output for connection into an amplifier.

Current consumption is around 10 mA, so a No. 216 9V battery should last a very long time with the sort of intermittent use this project is likely to experience.

Construction

We strongly recommend you use the pc board specified for this project. For a start, it simplifies construction, and secondly it reduces the possibility of wiring errors. With digital circuitry, bugs created by wiring errors can prove most frustrating to track down — particularly if you haven't had much experience with digital equipment. The project is not a difficult one; if you have had a small amount of experience constructing projects and finding your way around circuits and layout diag-



Component overlay. The pc board pattern will be reproduced next month on the 'PCB' page.

rams, then it should not prove too challenging.

It is best to commence construction by assembling the components on the printed circuit board. Leave the ICs till last – we shall see why shortly. Solder the crystal, the BC547 transistor, diode, resistors and capacitors in first. Watch the orientation of the diode, D1. Then do all the links using, say 22 gauge, tinned copper wire. There are six in all. Take care here, and refer to the overlay.

The two switches, the volume control potentiometer, the jack socket and the loudspeaker may now be connected – before being assembled to the front panel. Don't forget the battery connector. Use generous lengths of hookup wire – about 120 mm to 150 mm long. This makes for easy assembly of these components to the front panel.

Now the ICs may be inserted in the board and soldered. As they are all CMOS types, they should be handled with care. They will be supplied inserted in a conductive plastic foam or foil-wrapped styrene block. Remove them carefully. Take care to pick them up with your thumb and forefinger grasping the ends of the package, not touching the pins. Making sure you have them correctly oriented, insert them into the pc board. To check the orientation, look for a small indentation in the case immediately adjacent a pin at one end. This is pin 1. There may also be a large indentation in this end of the case. Note that all the ICs have the same orientation.

To solder the pins of the ICs, use an iron having an earthed tip and barrel. If you're unsure about this, use a clip lead to connect the iron's barrel to the negative supply rail on the pc board.

These measures will ensure you don't 'blow' the ICs with either static charges or leakage currents from the iron.

We assembled our prototype into a small 'zippy' box, measuring 160 mm by 96 mm by 50 mm. The aluminium front panel was drilled to take the controls positioned as shown on our template. You don't have to be too exact, there's plenty of leeway. Speaker mounting may seem a little mysterious. Several large holes were drilled where the cone faces the panel. The speaker may be glued in place or screws placed around the edge (only three are necessary) with large washers under the nuts overlapping the edge of the speaker, thus holding it in place. The panel on our prototype was covered with a Scotchcal overlay, as shown in the photograph. The sound from the speaker can be heard quite clearly through this and there is no need to cut holes in the Scotchcal. This helps protect the speaker, too.

Take care where you mount the jack socket. See that it clears the speaker magnet – with the jack plug inserted ! – when the panel is assembled and that it doesn't foul the pc board.

The pc board is held in place with four bolts and some 12 mm standoffs fixed to the base of the box. Mount it down one end so that the battery may be jammed between the end of the box and the pc board, using a small piece of foam rubber.

If you wished, this project could be powered by a small plugpack 'battery eliminator' – see Lab Notes on page 50 of this issue.

The last thing to do is check that you have the switches wired correctly. Make sure that when you switch from 440 Hz to 445 Hz the output goes a little sharp in pitch. If the volume control works in 'reverse', simply transpose the two wires going to the outside connecting lugs on the potentiometer. ●

PARTS LIST - ETI 606

Resistors all ¼W, 5%
- R1 . . . . . 10M
- R2 . . . . . 22k
- R3 . . . . . 10k
- R4 . . . . . 470R

Capacitors
- C1. . . . . 10p ceramic
- C2. . . . . 33p ceramic
- C3. . . . . 10n greencap
- C4. . . . . 100μ 25V electro

Semiconductors
- IC1, IC3 . . . . 4011B or C
- IC2 4020
- IC4 4068
- Q1 . . . . . BC548, BC108 or similar
- D1 . . . . . IN914 or similar

Miscellaneous
- RV1 . . . . . 10k log potentiometer
- XTAL 1 . . . . 3.579545 MHz Xtal (see text)
- SP1 . . . . . 8 ohm speaker
- SW1. . . . . SPST miniature toggle switch
- SW2. . . . . DPDT miniature toggle switch
- SK1. . . . . mono jack socket

9 V, No.216 battery or Plug Pack (Ferguson type PPA9 - DC or similar), ETI 606 pc board, Zippy box to suit (155 mm x 105 mm x 50 mm), knob, plug for jack socket (if needed).

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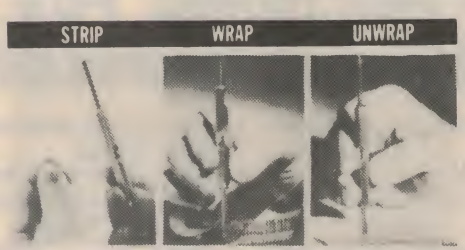
DIP/IC INSERTION TOOL WITH PIN STRAIGHTENER

14-16 Pin Dip IC Inserter	INS-1416



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Modified Wrap	WSU-30M

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30 AWG Yellow Wire 50ft Roll	R-30Y-0050
30 AWG White Wire 50ft Roll	R-30W-0050
30 AWG Red Wire 50ft Roll	R-30R-0050

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- Cuts the wire to length.
- Strips 1" of insulation.
- Refillable (For refills, see above)

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Yellow Wire	WD-30-Y
White Wire	WD-30-W
Red Wire	WD-30-R

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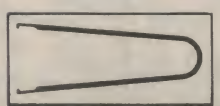
For AWG 26-28	BW-2628

Bit for AWG 30	BT-30
Bit for AWG 26-28	BT-2628

*USE "C" SIZE NI-CAD BATTERIES (NOT INCLUDED)



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Project 146

The 'Mainsmaster'

Jonathan Scott

An essential piece of equipment for the keen experimenter's workshop, service bench or test lab.

WHEN TESTING an item of newly-developed mains-operated equipment, or servicing a unit of commercial manufacture, the need often arises where the circuit's response to variations in mains voltage has to be examined. The performance of regulated power supplies is a typical case in point.

The traditional method is to use a "variac". This is a type of continuously variable autotransformer — constructed somewhat like an enormous wirewound potentiometer. A large dial moves a contact over the single winding — the output being taken between the contact and one end of the winding. The main drawback of the variac, for most hobbyists, experimenters — even servicemen, is cost. Secondly, it may do more than is necessary for most people's applications.

Boost or buck

The simple and inexpensive, solution is to connect a suitable step-down transformer as an autotransformer with switching arranged to 'boost' or 'buck' the mains voltage by a small, fixed percentage. This will do the same job as a variac, but over a limited range, and allows scope for a few useful additions — such as monitoring the load voltage and current.

Thus, we have the 'Mainsmaster'.

This project uses a very common stepdown transformer having a 25-0-25 volt secondary. This is switched in series with the output socket so that, when the whole secondary is connected *in phase* with the mains, it will *add* 50 volts increasing the output by about 20%. When only *half* the secondary is connected in phase, the output voltage will increase by about 10%.

Similarly, when the whole secondary is connected *out of phase* with the mains, the output will *decrease* by 20%; with *half* the secondary connected out of phase the output will decrease 10%.

As the transformer secondary is rated at 2A, loads up to about 500 W may be run from the Mainsmaster.

To monitor the output voltage and current a series of resistors and diodes provide rectification and voltage and current scaling for a commonly available 1 mA meter movement. A new scale has been provided, marked with the appropriate voltage and current scales.

Standard, inexpensive, mains-rated toggle switches are used to arrange the boost and cut, meter switching and switching of the output direct to the mains.

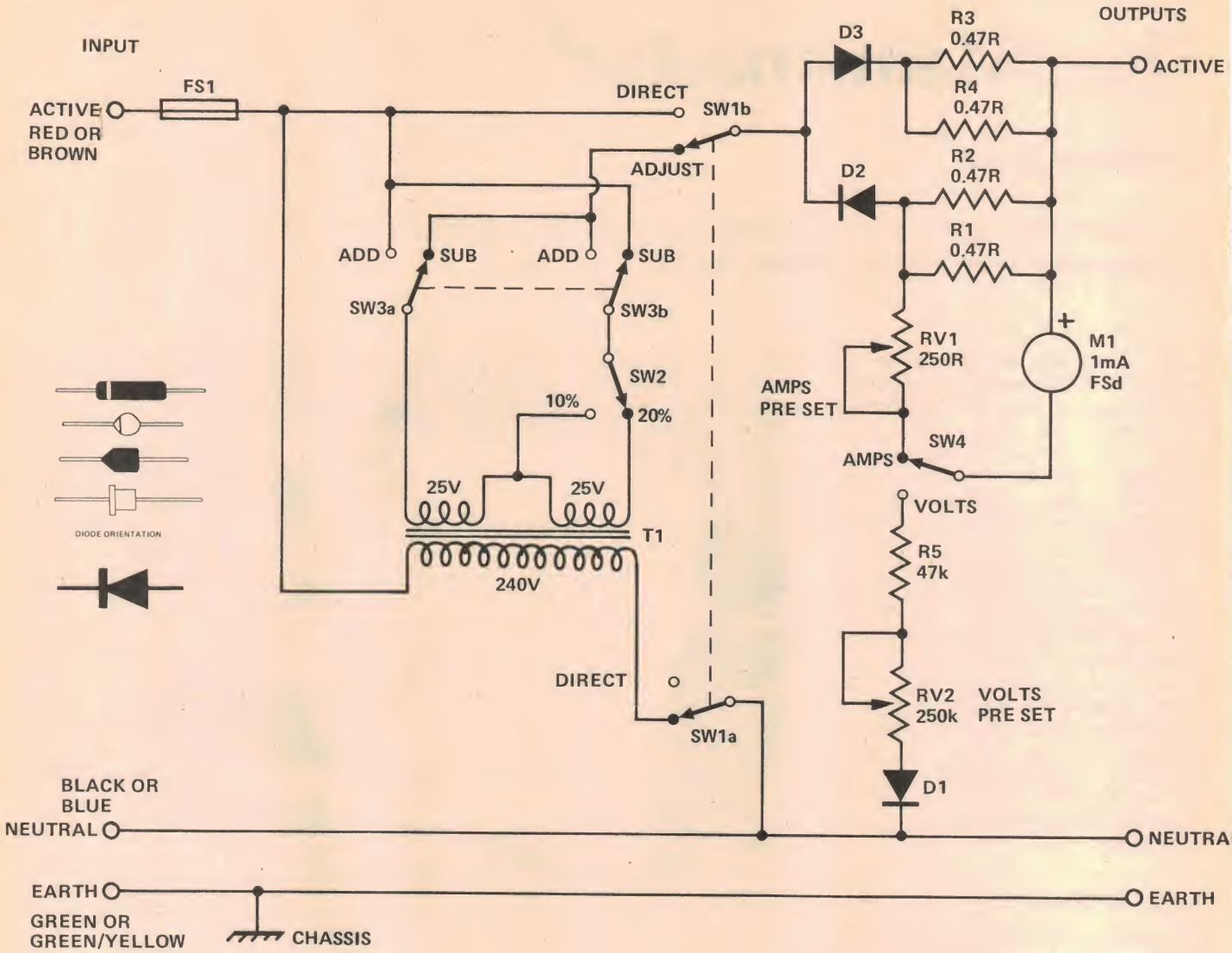
Construction

Since the whole circuit is at active mains potential we recommend that the three-pin plug be fitted last of all!

Unless you are competent to do so, it would be wise not to deviate from our design in any detail.

Construction is relatively simple, with only the meter, diodes and transformer needing to be connected a particular way around. All switches need to be 240 V rated. We used DPDT switches for SW1-SW4 though only two need to be DPDT rather than SPDT. This was because we could not readily locate 240 V AC switches of identical appearance in both DPDT and SPDT. It is advisable to use the pc board shown as it forms a solid, reliable mount for the trimpots.

A number of sensible construction practices should also be included. Firstly, use a proper cord clamp for the mains cord. Earth the transformer and front panel. (Our transformer is bolted to the front panel and both earthed). ▶



It is advisable to use a robust box, an all-metal diecast one being the best, though expensive. Use proper 240 V AC rated hookup wire (known as 23 x .0076).

After the interconnections have been completed according to the diagram the calibration of voltage and current ranges remains. Do not attempt to adjust the trimpots with the unit plugged in. These should be adjusted in small steps, each adjustment being made with the unit disconnected. The meter should be set to agree with a multimeter or reference instrument measuring across a purely resistive load, such as 200-300 watts worth of incandescent lamps. Remember that the unit is only rated to 2 A, so only 500 W can be drawn continuously. The fuse will limit the output current to 3 A. ●

MAINS WIRING

Constructors should keep in mind a number of simple rules when doing any 240 Vac mains wiring.

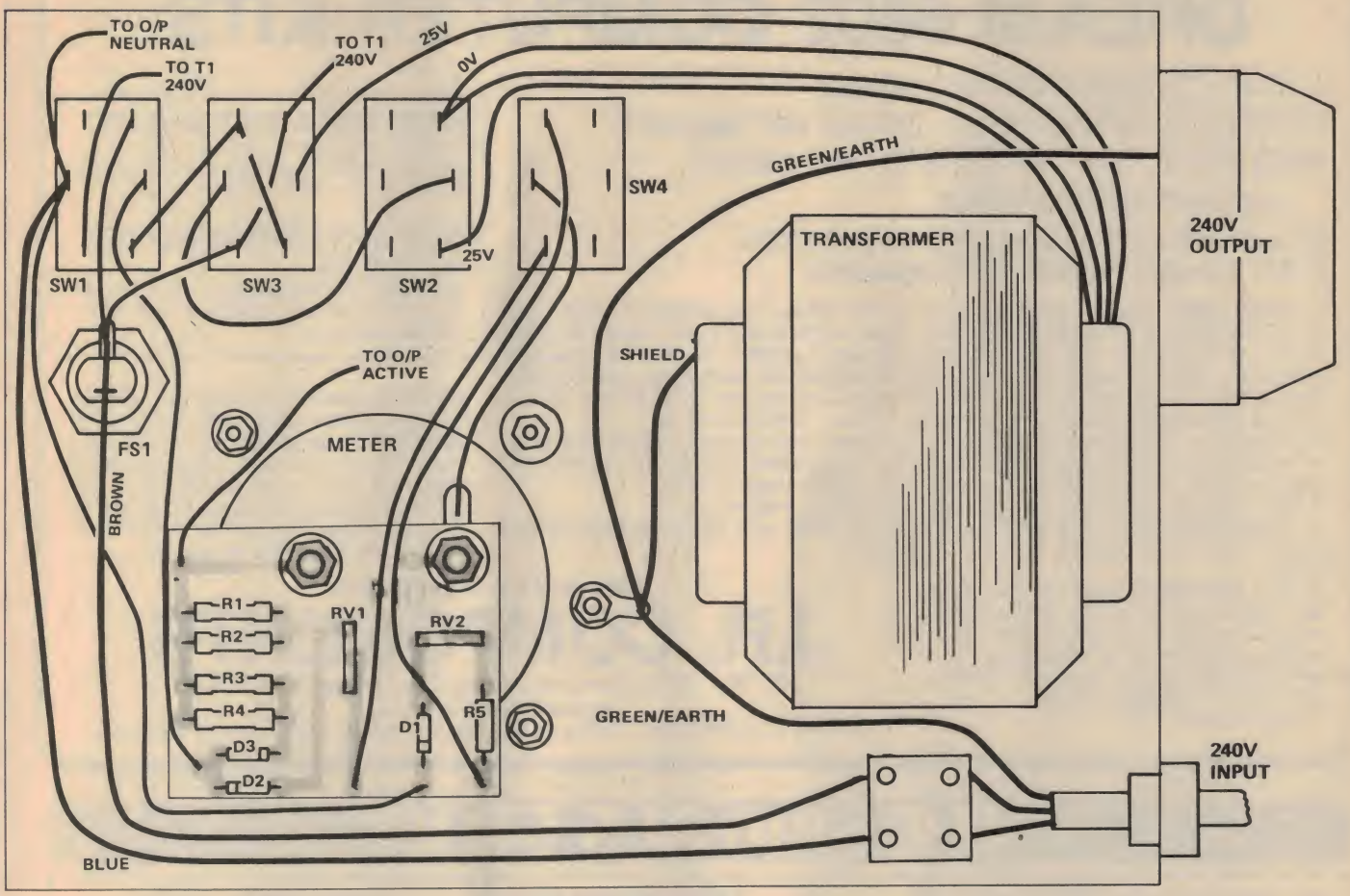
Firstly, the input cord should be standard, approved three-core flex. Not "figure-eight" flex. It should be secured to the case of the equipment with either a clamp-type grommet or passed through a standard rubber grommet and secured inside the equipment by a proper cable clamp. Knotting the cable is not good enough – and dangerous.

The active and neutral wires must be terminated, immediately inside the equipment, to a terminal block. The earth wire must be longer and earthed via a lug under a bolt and nut used for that purpose alone so that, if the clamp fails under any circumstances, the earth lead will be the last to break. If any subsequent wiring passes through a metal partition or chassis it should be sleeved or a small grommet inserted in the chassis hole.

Do not pass mains wiring over any circuitry within a piece of equipment. Route it around, keeping well clear of components. Use cable ties. Keep mains wiring well separated from low voltage wiring, preferably at opposite ends of the chassis of a piece of equipment. This also reduces the likelihood of hum pickup in sensitive circuits, such as high gain amplifier stages.

Use electricity authority approved transformers (see ETI, September 1979, page 13) and three-pin plugs.

Follow these directions and you should live to enjoy your hobby for many years.



PARTS LIST – ETI 146

Resistors
all ½W 5%
R1-R4 . . . . .0.47R
R5 . . . . . .47k
RV1 . . . . . .250R
RV2 . . . . . .250k

Semiconductors
D1-D3 . . . . .EM4004 or sim.

Switches
SW1, SW3 . . .DPDT 3A, 240 Vac switch
SW2, SW4 . . .SPDT or DPDT 3A 240 Vac switch

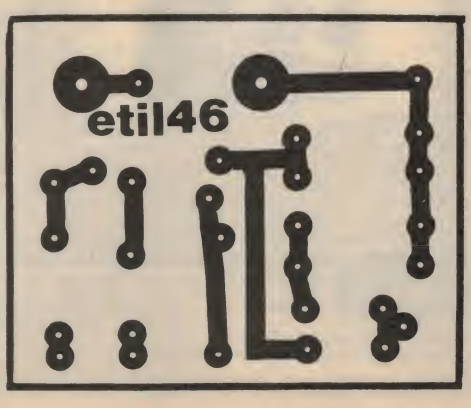
Miscellaneous
FS1. . . . . .3 A (3AG) fuse and fuse holder
T1. . . . . .Ferguson PF3259, 25-0-25V 2 A transformer or similar.
M1 . . . . . .1 mA, 65 mm square panel meter

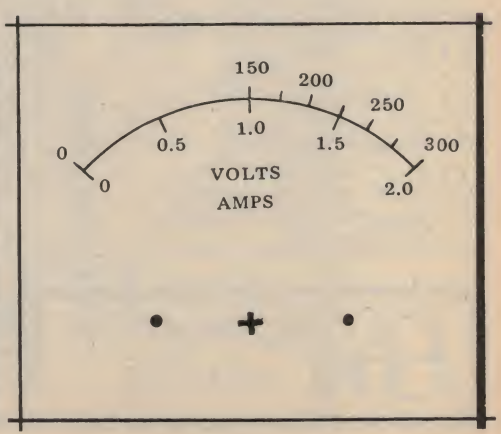
Diecast box 200 x 125 x 100 mm, 3pin mains panel mount socket, ETI 146 pc board, cable clamp, mains cord and plug, rubber feet.

HOW IT WORKS – ETI 146

The circuit may be divided clearly into two parts: the voltage switching part, and the metering part. The switching part works simply by switching either half or all of the secondary of T1 in series with the mains supply – either in phase to add, or 180° out of phase, to subtract. This is controlled by SW1, SW2 and SW3. SW1b removes the 240 V AC from the transformer when the direct connection is used. The whole circuit (and load) is protected by F1.

The metering part measures volts and amps. Diode D3 rectifies the voltage across the load. R5 and RV2 set the meter range to 300 V AC FSD. R1-R4 with D1-D2 form a (symmetrical) 2 A shunt for the meter which allows it to pick off DC (since the meter sees only the current in R3/R4). RV1 sets the current sensitivity.





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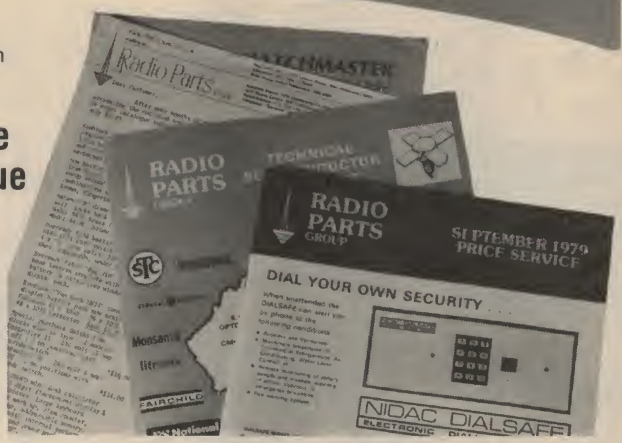

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Lab Notes

An occasional series in which we discuss interesting circuit techniques, circuits we have tried in our own laboratory but not developed as a project, practical notes on projects, measurement techniques for hobbyists etc.

"Plug Pack" battery eliminators

About the most convenient and least expensive mains power supplies suitable for powering our simple battery-operated projects are these "Plug Pack" battery eliminators. At left is the PS369 from A&R Soanar – this unit gives three, selectable, voltages and comes with a range of output connectors, a very versatile unit. At right is the PPA9-DC from Ferguson Transformers Pty Ltd, which delivers 9 Vdc at up to 3 VA.

LOOKING THROUGH our pages each month, as well as the 'Project Electronics' and 'Simple Projects' series, reveals a myriad of simple projects, most of which use a single nine volt power supply. In fact we try to design all our simple projects to use the common No. 216 transistor radio battery.

After building a few of these projects you may have thought a simple mains power supply would be a good idea to reduce the turnover of batteries, which in some cases are the most expensive item in the circuit! The power supply would not have to be complicated, good regulation being unnecessary for most of these projects, but by the time you bought a transformer, diode bridge, filter capacitor, box and leads you would have spent the best part of $15. That's about 20 batteries worth at today's prices – and chances are if you're a newcomer to electronics, building our simpler projects, you shouldn't be thinking of building mains powered equipment for a while. We'd like to keep our enthusiastic readers – not kill them off !

The two largest Australian transformer manufacturers, Ferguson Transformers Pty Ltd and A & R Soanar Pty Ltd, have come to the rescue with a range of "Plug Packs". These consist of a small plastic case containing a small transformer, diode rectifier and filter capacitor. The case has a moulded-in mains plug (generally two pins) allowing the whole unit to be plugged into a standard 240 Vac outlet. A twin-lead

and low voltage connector provides output connection.

Originally designed to power portable radios, calculators and cassette recorders, they are available in a range of voltages and power ratings, and are ideally suited to powering our simple projects.

Ferguson plug packs are locally made and available in 3, 4½, 6, 7½, and 9 volts at a rated output of 3 VA (watts) or 500 mA, whichever is the greater. They are terminated in a standard connector found on most portable equipment. The nine volt version (PPA 9-DC) is probably the most useful, to project constructors, of the Ferguson range and retails for $7.19 inc. tax (Ferguson price).

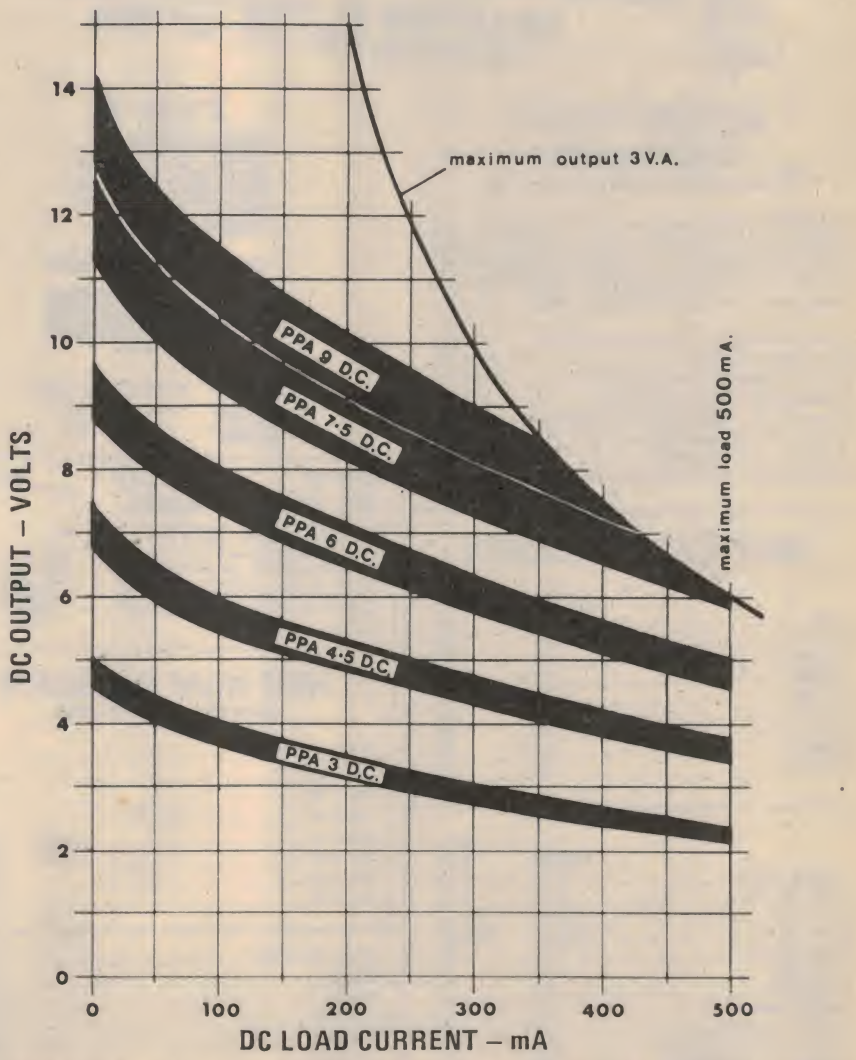
A&R Soanar have come up with a novel idea in one of their Plug Packs. Rather than have a range of different voltage packs they use a single pack with a tapped transformer to give three, six or nine volts at an output of 300 mA. These have a multi connector with two sizes of jack plugs, two sizes of low voltage coaxial type connector and a battery clip for equipment without a remote power socket. Priced at around $10 it is more expensive than the Ferguson range and has a lower output current but offers greater flexibility. You need to be careful though when using them not to short out the unused connectors.

Output voltages are rated at a specific current. As the supplies are un-regulated the output voltage will be higher at low currents and fall below the rated output at high currents. This poor regulation will not effect most battery equipment or the operation of our projects, in general.

The graph here gives the output voltage for specific currents for each of the Ferguson range. The maximum current for the lower voltages is limited at 500 ma and at 3 VA for the higher voltage packs. The 3 VA curve can be seen at the top right of the graph. If an output of say 12 V dc at 40 mA is required it can be seen that a 9V Plug Pack will do nicely, however this drops to about 8 V at full load.

Plug Packs can also be used for charging Nickel-Cadmium (NiCad) batteries if the right pack is selected for the capacity and voltage of the batteries to be charged. Nicads must not be charged with a current greater than one tenth of their amp-hour capacity. The PPA9-DC will supply 400 mA maximum current and can be used to charge a 12 V 4 AH Nicad pack. Smaller NiCad packs will require a series resistor to limit the maximum charging current. Penlite size cells requiring only 40 mA charging current will require about a 330 ohm series resistor.

Plug Packs can be obtained from many of the suppliers who advertise in the magazine, and you should have little difficulty obtaining what you require.



Curves showing the output voltage ranges and regulation for the various Ferguson model "Power Pack" battery eliminators. All deliver their rated output voltage at a current of 300 mA. They will give a higher voltage at low load currents and lower output voltage at high load currents, but note that the 3 VA (that's 3 watts generally in the applications we suggest) must not be exceeded for the PPA9-DC or PPA7.5-DC units. The width of each curve indicates the maximum and minimum output voltages for each unit.

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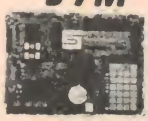

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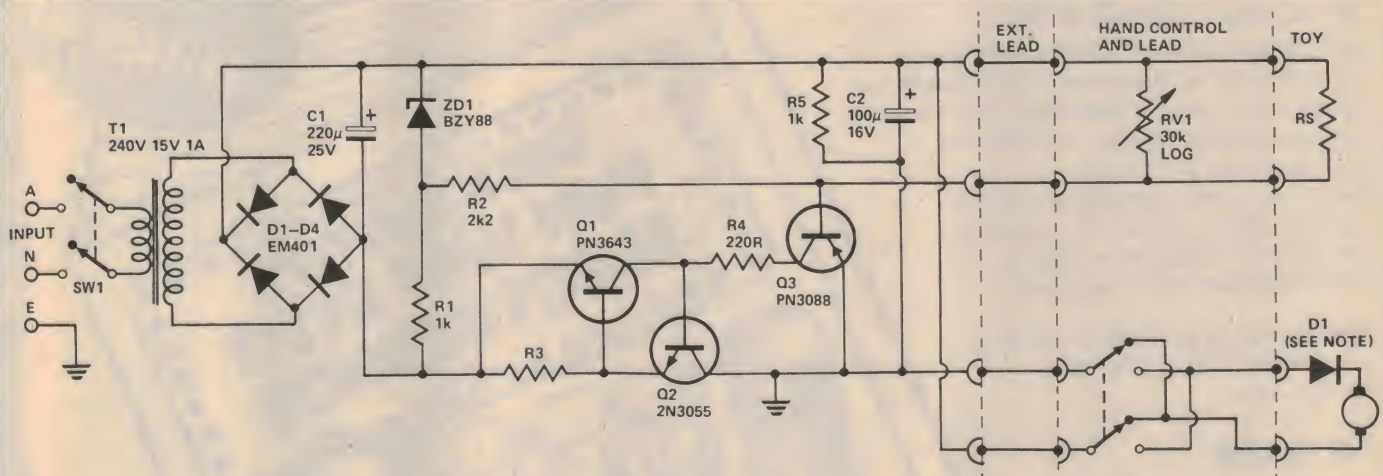
Ideas for Experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.



Power supply suits battery-operated toys

Here is a power supply for toys such as race tracks, cars, Meccano motors etc. modified from the ETI 221 Basic power supply.

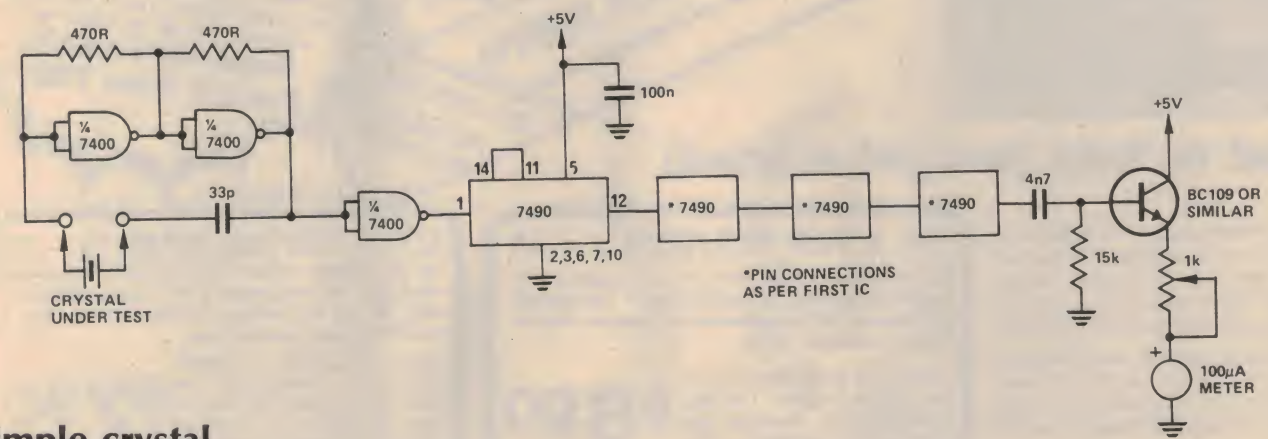
The power supply components are fitted inside a metal box with the 2N3055 in contact with the case. R6 is a hand-made wire resistor adjusted to get one amp output current with the output shorted. A small four pin socket is mounted on the case for the output.

A four core extension lead is made to go between the power supply and the toys, with plugs on both ends.

A four pin socket is fitted to each toy so that one extension lead is sufficient for all toys. Resistor RS is fitted to this socket to set the correct voltage. RS is 1k for 3 volts, 1.8k for 4.5 volts, 3k for 6 volts and 10k for 9 volts.

For cars with no speed or direction control a hand control unit goes between the extension lead and the cars. Control is by a 30 k log pot and a double pole change over switch fitted in a tobacco tin.

Diode D5 is fitted only to toys that must not go in reverse.



Simple crystal frequency meter

Have you ever had a whole heap of crystals which are unmarked or stamped with a frequency which is not the crystal frequency but rather the output frequency of a transmitter.

John Rickard of Heathmont, Vic. Certainly has and he has submitted his circuit for a crystal frequency meter. The meter gives a direct reading of frequency on a moving coil meter for crystals in the range 500 kHz to 10 MHz.

Two gates of a 7400 form a crystal oscillator with a third gate used as a buffer. Four 7490s divide the crystal frequency by 10,000 to give an output between almost zero and 1 kHz. This output is differentiated by C2 and R3 and the meter integrates the pulses giving a linear frequency scale. Overtone crystals will oscillate at their fundamental in this circuit which may be misleading. To calibrate the instrument adjust R4 with a known crystal in circuit.

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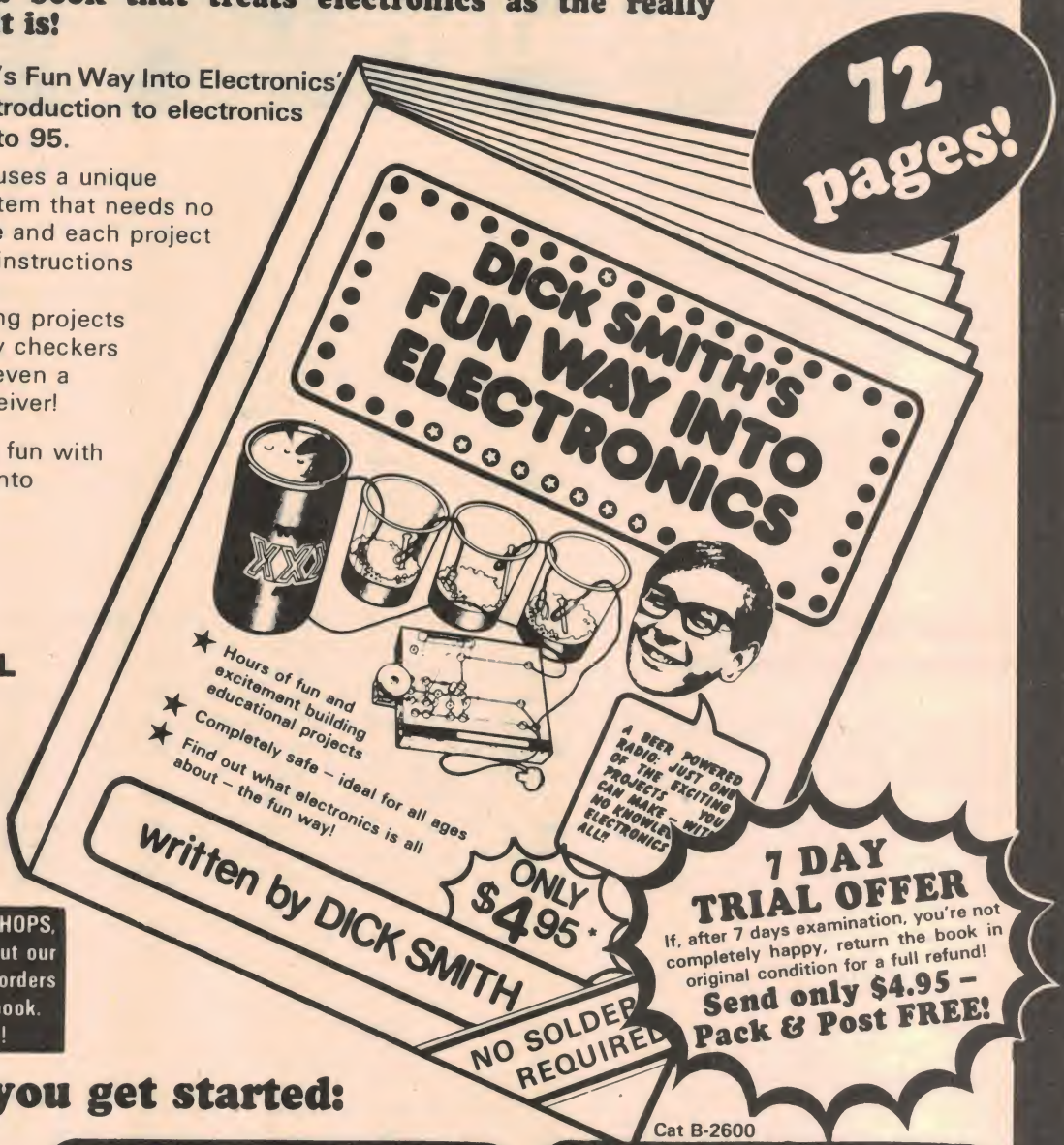

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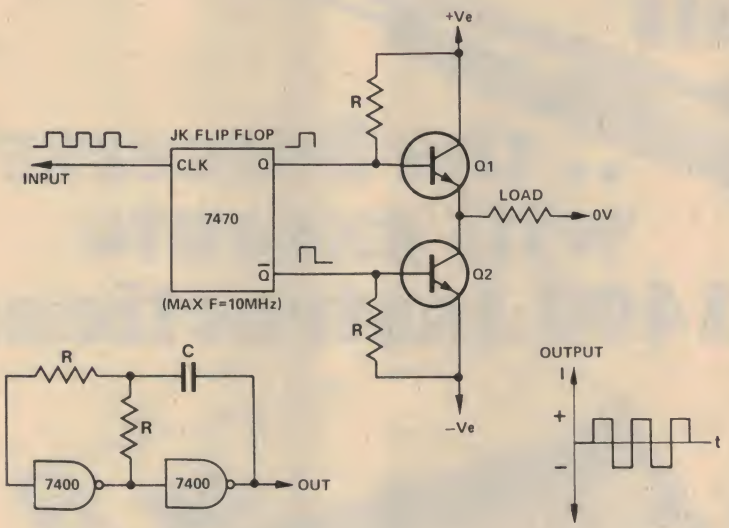


TTL squarewave generator has 5 watt output

Although many square wave generators have been designed in the past many have two inherent disadvantages; namely, low power and pulses offset above OV.

This square wave generator, from **William Carson of Mt Waverly Victoria,** gives a power output of 5 W with a ±5 V supply in an 8 ohm load. Transition between levels is fast and no ringing occurs on the edges.

The transistors should be fast switching types such as 2N3563 or 2N3564. The input to the flip flop can be a TTL or unijunction oscillator.

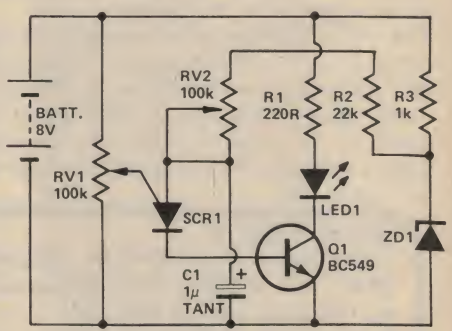
Battery state indicator

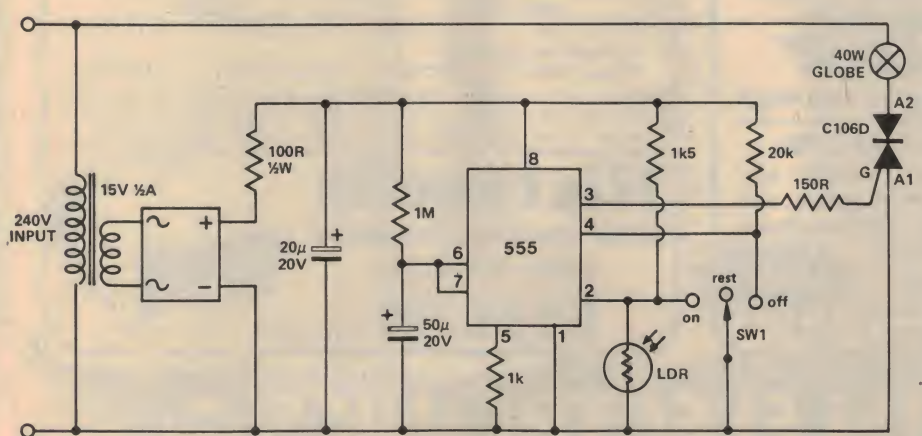
A flashing LED can be used to give an accurate indication of the state of a battery, without using a lot of battery power. The circuit shown can be adapted to batteries from 4V to 16V by selecting R1 to limit the LED current to about 20 mA and choosing ZD1 about 1V lower than the voltage of a flat battery.

RV1 sets an upper voltage, below which the LED flashes; the flash rate increasing as the voltage drops. RV2 sets a lower voltage, below which the LED is continuously lit, and this should be used to indicate the need for immediate battery charging or replacement.

If a stable reference voltage is available elsewhere in the equipment, this may be used instead of R3 and ZD1.

Now that's quite a cunning idea, from **F. Gillespie of Findon W.A.**





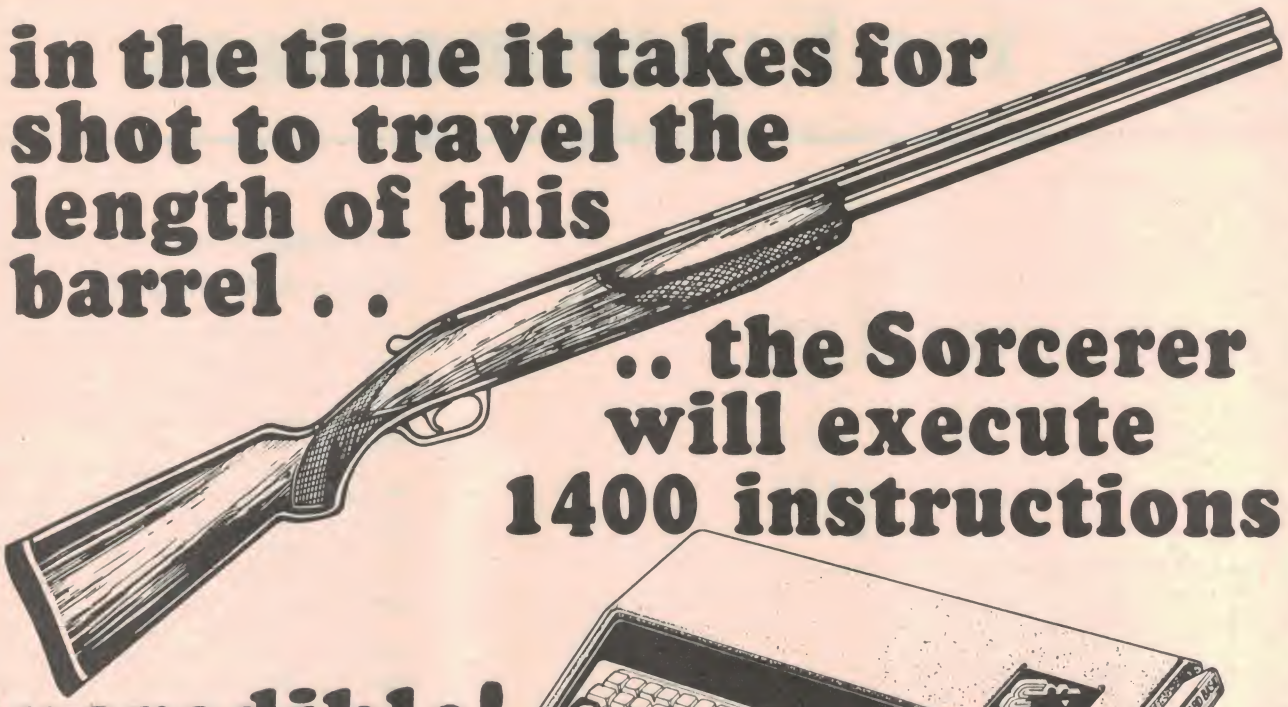
Auto garage light

The circuit here, from **Andrew Murn of Clarence Gardens** in South Australia, was used to turn on a 40 Watt light in a garage.

The car headlights drop the resistance of the LDR, triggering the 555 timer, turning on the light.

The light can be manually turned on or off by the single pole two position switch SW1. The LDR must be shielded from daylight or it will trigger at sunrise. The time delay for the light to turn off is set by the value of the 47 μF electrolytic capacitor.

in the time it takes for shot to travel the length of this barrel . .



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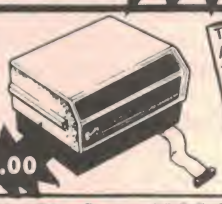

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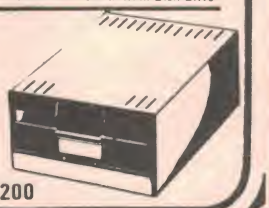

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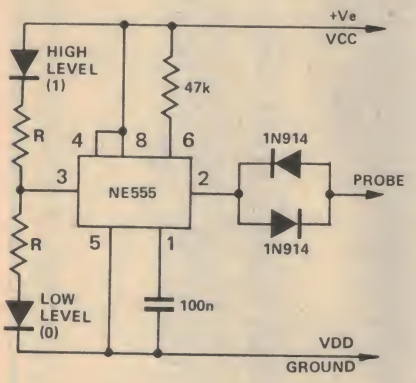


Simple logic probe uses 555 chip

Alan Reek, of Woolwich in Sydney, devised this simple logic probe around a 555 timer IC. This circuit has the advantage that it places very little load on the circuit under test. As shown, the circuit can be used with TTL (R=120 ohms). For CMOS circuitry using a supply rail above 5V, the LED current limiting resistors should be increased.

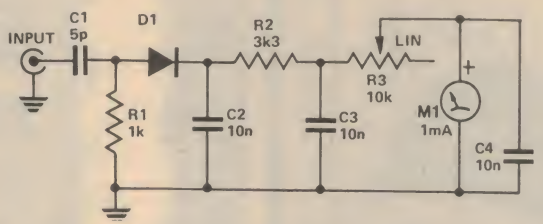
Power for the probe is taken from the device under test. Because of the few components it can be housed in a small pill container (plastic) or a commercial probe container can be used.

Square wave inputs will cause both LEDs to light equally and the duty cycle of the input can be estimated by the relative brightness of each led. A small silicon diode could also be connected in series with the Vcc line so as to prevent damage to the probe if the wrong polarity is applied to the circuit.

RF monitor meter

A simple RF and modulation monitor is always a handy instrument to have around the shack. This one should cost less than $10 – half that if you use a 'surplus' bargain meter movement. The input could be taken from two coax connectors mounted in a small box with their centre conductors connected together – providing a through connection so that the unit may be slipped in series with the transmission line to the antenna.

Just about any small signal silicon or germanium diode may be used for D1 – like 1N914, 1N4148, OA200, OA202, AA119, OA90, OA91, OA95 etc.



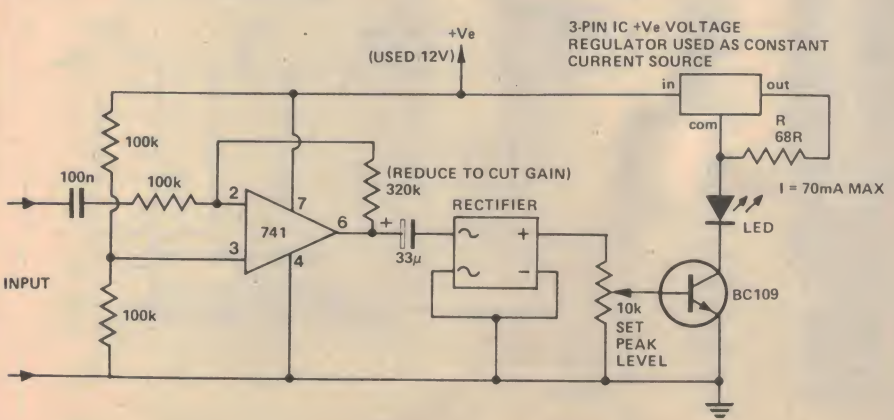
Capacitor C2 should have very short leads for best effectiveness. At VHF its value could be reduced to 470 pF or 1 n. The pot, R3, is a sensitivity control. The value of C1 should be varied so that full scale deflection is obtained with the usual RF power used with R3 at maximum resistance. Alternatively, the 'free' end of R3 could be connected to ground to provide a greater range of control.

When using the monitor on SSB transmissions, C3 may be increased to say 100 n or as much as 1 uF to provide some 'hand' for the meter indication.

LED indicator's many uses

This circuit, from T. Threlfall of Nedlands WA, was originally designed as a peak audio detector to supplement inaccurate moving-coil VU meters in a recording preamplifier susceptible to clipping. In this application it has limitations as the LED brightness varies with the variable conductance of the transistor: an improved circuit may use a UJT or FET with better results.

An alternative use is as a low cost visual display – a "musicolor" on a very small scale with low-level input requirement; while level displays using several LEDs may be better, the cost is high.



The gain of the 741 can be adjusted down if desired, by reducing the 320 k resistance.

.The "rectifier" used was from a damaged moving coil meter; connecting the negative output to ground gave a higher output than leaving it floating. This type of rectifier has a lower voltage drop than silicon diodes, and may be useful if extreme sensitivity is needed. Otherwise, a single diode suffices.

The voltage regulator output current was made high for brighter illumination and can be reduced by increasing R from 68 ohms.

The transistor type is unimportant if current rating is not exceeded. A PNP type could be used if the positive output terminal of the rectifier is grounded and the negative terminal is used as output.

(more on page 61) ▶

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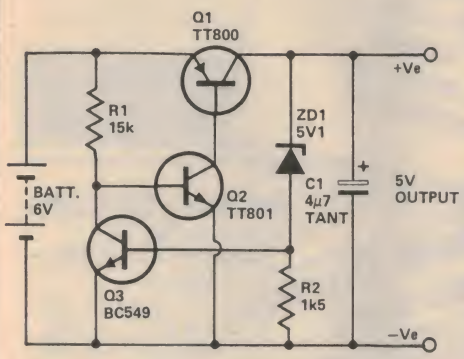


Stabiliser for battery supplies

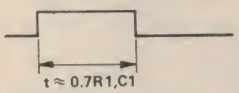
The accompanying circuit, is useful when voltage sensitive devices (such as TTL ICs) must be battery operated. It uses very little power from a good battery; whilst with a flat battery, the output voltage is within 0.1V of the battery voltage.

ZD1 should be selected to obtain approximately the desired output voltage; for fine trimming, R2 may be selected between 470 ohms and 3k3. With the components shown, the output voltage varies less than 2% for battery voltages from 5V to 8V and output currents from zero to 200 mA. For higher currents, R1 may need to be decreased.

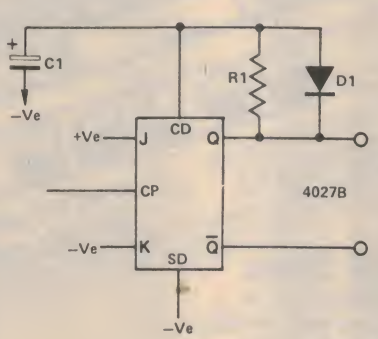
Always use a power transistor for Q2 or it will overheat when the battery is nearly flat. Both Q1 and Q2 should have a current gain of at least 40, while the gain of Q3 should be as high as possible.

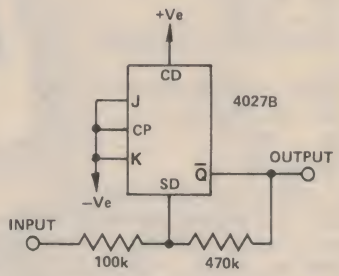
CMOS monostable

Barry Wilkinson (of Nebula Electronics) devised this mono using a 4027B CMOS JK flip-flop. The time constant is set by R1C1, and D1 speeds the discharge of C1.



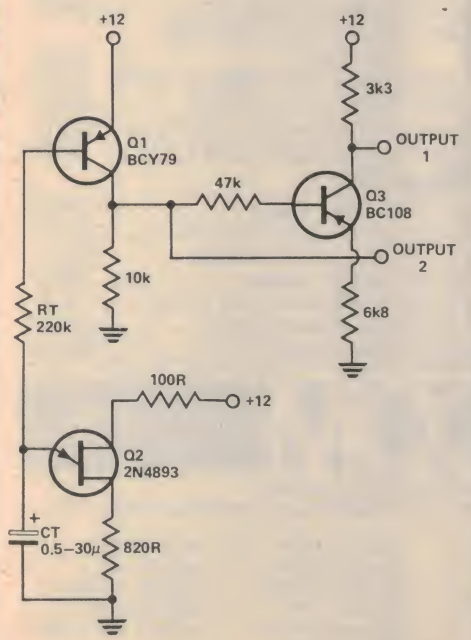
OUTPUT PULSE OCCURS ON POSITIVE EDGE OF OUTPUT





Simple CMOS Schmitt

This simple Schmitt circuit, from **Barry Wilkinson** of Nebula Electronics, is based on the 4027B and offers Schmitt voltages centred around half the supply voltage, set by the ratio of the feedback resistor to the input resistor, in a manner analogous to the gain of an op-amp.



Sweep generator for VCO

A sudden and immediate need for a sweep circuit to drive a 566 VCO led **J. Elkhorne**, of Chigwell Tas., to devise this circuit.

The circuit is by no means critical as several different general purpose active devices were tried.

Forward bias through the emitter-base junction of Q1 provides a charging current for a timing capacitor; this exponential curve is amplified in Q1 and taken from the collector circuit to provide a descending sweep of the 566. The signal is also routed to Q3, a simple inverter, to provide an ascending sweep voltage.

The UJT will not drive the 566 directly, as voltage divider action between the timing resistor and the IC drops enough voltage to keep the unit from firing.

Any ideas?

Have you had a bright idea lately, or discovered an interesting circuit modification? We are always looking for items for these pages so naturally, we'd like to hear from you.

We pay between $5 and $10 per item — depending on how much work we have to do on it before we publish it.

The sort of items we are seeking, and the ones which other readers would like to see, are novel applications of existing devices, new ways of tackling old problems, hints and tips.

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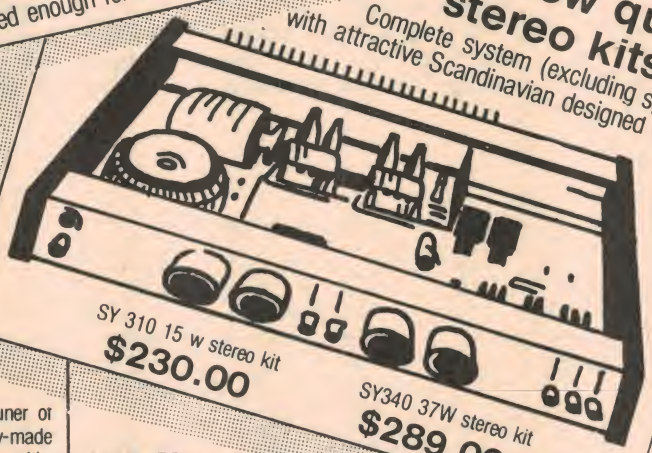

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7416	.60
7417	.65
7420	.25
7421	.30
7422	.35
7426	.40
7427	.40
7430	.30
7432	.30
7437	.40
7438	.40
7439	.50
7440	.30
7442	.80
7447	.90
7448	1.10
7450	.30
7451	.30
7453	.30
7454	.30
7460	.30
7470	.50
7472	.55
7473	.55
7474	.35
7475	.45
7476	.40
7480	1.00
7483	1.40
7485	1.40
7486	.55
7489	2.90
7490	.40
7491	1.00
7492	.80
7493	.50
7494	1.15
7495	1.00
74100	2.00
74107	.70
74121	.70
74123	.85
74132	1.30
74145	1.50
74150	1.50
74151	1.40
74153	1.40
74154	1.40
74157	1.40
74160	1.70
74165	1.70
74172	1.40
74173	2.60
74175	1.20
74180	1.50
74188	3.00
74192	1.80
74193	1.80
74367	.80

74LS SERIES TTL

74LS00	.25
74LS01	.30
74LS02	.30
74LS03	.25
74LS04	.25
74LS05	.30
74LS08	.30
74LS09	.30
74LS10	.20
74LS11	.35
74LS12	.30
74LS14	.80
74LS15	.75
74LS16	.60
74LS20	.30
74LS21	.30
74LS27	.30
74LS28	.35
74LS30	.30
74LS32	.30
74LS37	.40
74LS38	.40
74LS40	.30
74LS42	.45
74LS73	.60
74LS74	.40
74LS75	.50
74LS78	.65
74LS85	1.40
74LS86	.60
74LS90	.60
74LS92	1.00
74LS93	.85
74LS95	1.00
74LS107	.65
74LS109	.50
74LS113	.50
74LS114	.55
74LS125	.70
74LS133	.30
74LS138	1.10
74LS151	1.00
74LS157	.75
74LS160	.70
74LS163	.80
74LS164	1.40
74LS165	1.40
74LS169	1.90
74LS174	.65
74LS175	.90
74LS190	1.60
74LS191	1.30
74LS192	1.15
74LS193	1.00
74LS194	1.20
74LS195	1.00
74LS196	1.60
74LS197	1.60
74LS221	1.50
74LS247	1.95
74LS251	.85
74LS253	.85
74LS257	.75
74LS259	2.20
74LS279	.70
74LS290	1.30
74LS365	.80
74LS366	.80
74LS367	.70
74LS368	.65

CMOS 4000 SERIES

4000	.25
4001	.25
4002	.25
4007	.30
4008	1.20
4011	.38
4012	.30
4013	.65
4014	1.40
4015	1.20
4016	.60
4017	1.30
4018	1.30
4020	1.40
4021	1.30
4022	1.30
4023	.30
4024	1.00
4025	.30
4027	.70
4028	1.00
4029	1.40
4030	1.20
4040	1.40
4042	1.20
4043	1.00
4044	1.00
4046	2.20
4049	.70
4050	.75
4051	1.20
4052	1.20
4053	1.20
4060	1.50
4066	.90
4068	.35
4069	.30
4070	.30
4071	.30
4072	.30
4076	1.75
4077	.30
4078	.30
4081	.30
4082	.30
4093	.70
4441	.95
4502	1.40
4506	.70
4510	1.50
4511	1.30
4518	1.50
4520	1.40
4528	1.40
4553	6.90
4555	1.00
4581	3.50
4582	1.40
4584	1.00
40014	.90
40097	1.00
40098	1.20

CMOS 74C SERIES

74C02	.35
74C04	.35
74C08	.35
74C10	.35
74C20	.35
74C48	2.50
74C73	1.10
74C76	.95
74C90	1.40
74C93	1.40
74C175	1.70
74C192	1.90
74C193	2.70

LINEAR IC's

301	.40
307	.70
308	1.20
310	2.60
311	.70
318	3.25
324	1.00
380	1.50
381	2.30
382	2.00
3900	.95
3909	1.30
555	.30
556	1.20
565CH	3.30
566	3.10
567CH	3.00
709	.70
710	.80
711	.80
741	.30
747	1.00
748	.60
1458	.60
2917	3.20
3302	.70
3401	.80
7392	3.30
CA3046	1.65
CA3086	.65
CA3130	1.50
CA3140	1.50
MC1494L	6.65
OM350	7.90
RC4136	1.45
TL071	.80
TL081	1.20
TL081	.70
TL082	1.20
TL084	2.30

DIODES

AAY30	.40
BYX71-350	1.20
OA90	.15
OA91	.15
OA95-1000	.70
1N3493	1.70
1N3493R	1.70
1N4002	.10
1N4004	.10
1N4007	.20
1N4148	.06
1N5401	.40
1N5404	.40
1N5408	.80
P600G	.90

BRIDGE RECTIFIERS

VM48(400V,1A)	1.50
W02(200V, 1½A)	.75
MDA201(2A)	.95
MDA3501(35A)	3.40

INTERFACE

1488	1.00
9368	2.30
8T24	2.20
8T26	2.20
8T28	2.20

PROMS

93448	10.50
2708	14.00

VOLTAGE REGULATORS

309K	1.90
317T	2.90
317K	2.90
723	.55
7805	1.00
7805K	2.10
7812	1.00
7812K	2.40
7815	1.00
7818	1.00
7824	1.00
78H05	7.50
78H12	7.50
78HG	7.95
78L05	.40
78L09	.40
78L12	.40
78L15	.40
78L18	.40
78L24	.40
78CB	2.40
78MGT2C	1.80
7905	1.60
7905K	2.95
7908	1.60
7912	1.85
7912K	2.60
7915	1.60
7918	1.60
7924	1.60
79HG	10.80
79L03	.80
79L05	.80
79L12	.80
79L15	.80
79L18	.80
79L24	.80
79MGT2C	1.80

STATIC RAM

2102A-4	1.90

COUPLER

MCT2	1.20

MICRO

TMS1000	7.95

DISPLAYS

FND357	1.40
FND500	1.40
DL747	3.50

ZENER DIODES

½W(3V3-33V)	.19
1W(3V3-33V)	.30
2½W(8V2-18V)	.65
5W,5V1-12V-15V	1.20

SCR's

C103YY	.80
C106Y	.65
C106D	.75
C106E	.70
C122D	1.30

TRIAC's

SC141D	1.30
Q1015L5	2.80

TRIGGER DIODES

ST2	.55
ST4	.80

LEDS

RED (Std)	.18
GREEN (Std)	.30
YELLOW (Std)	.30
TIL209	.18
FRGD. Std Led Inc. Flasher IC	2.30
SEL102S M/R	.30
SEL103S M/R	.30
SEL302E M/G	.40
SEL303E M/G	.40
SKNR(BEZEL)R	1.20
SKNG(BEZEL)G	1.70
SKNY(BEZEL)Y	1.50
SEL351(BEZ)G	1.10

TAG TANTALUMS

0.1uf 35V	.20
0 15uf 35V	.20
0.22uf 35V	.20
0.33uf 35V	.20
0.47uf 35V	.20
0.68uf 35V	.20
1uf 35V	.20
1.5uf 35V	.20
2.2uf 35V	.20
3.3uf 35V	.20
4.7uf 16V	.20
4.7uf 35V	.30
6.8uf 35V	.30
10uf 25V	.25
10uf 35V	.30
15uf 35V	.55
22uf 16V	.30
22uf 35V	.74
33uf 10V	.30
47uf 6.3V	.40
47uf 16V	.55

MIN. CERAMIC

1pf-0.03	.06
0.047	.08
0.1uf	.12
0.22uf	.20
0.47uf	.25

POLYESTER

100V

.001-.027	.10
.033-.056	.12
.068-.1	.16
.12-.22	.30

250V

0.27uf	.30
0.33uf	.34
0.39uf	.48
0.47uf	.50
.56,.68,.82	.60
1,1.2,1.5	1.00
1.8uf	1.20
2.2uf	1.40
3.3uf	2.10
4.7uf	3.50

TRIM. CAPACITORS

0.4pf-5.5pf	.30
2pf-22pf	.40
5pf-65pf	.30
5.5pf-40pf	.40

ELECTROLYTIC. PCB.

6.3V	470uf	.20
	1000uf	.30
10V	4.7,100uf	.10
16V	10uf	.08
	22,33,47uf	.10
	100uf	.15
	220,330uf	.20
	470uf	.25
	640uf	.45
	1000uf	.40
	2500uf	.65
25V	2.2,3.3uf	.10
	4.7,10uf	.10
	25,33uf	.12
	47uf	.13
	100uf	.15
	220uf	.20
	330uf	.25
	470uf	.35
	1000uf	.50
	2200uf	.90
35V	2.2,3.3uf	.10
	10uf	.15
	100uf	.20
	220uf	.30
	1000uf	.70
	2000uf	.90
	2200uf	1.10
50V	.47 1 2.2	.08
	3.3 4.7 10	.15
	22 33 47	.20
	100uf	.20
	220uf	.50
	470uf	.60
63V	.47 1 2.2	.10
	3.3 4.7uf	.10
	10 25uf	.15
	47uf	.20
	100uf	.25
	220uf	.40
	330uf	.45
	470uf	.80

ELECTROLYTIC RT. (DOUBLE ENDED)

16V	33uf	.15
	330uf	.40
25V	100uf	.25
	330uf	.45
	2500uf	1.00
50V	2500uf	2.15
63V	10uf	.16
	47uf	.30
	100uf	.40
	220uf	.65
	470uf	.75

(CAN TYPE, RG/D/P)

2500uf 35V	1.60
5600uf 40V	2.40
3300uf 75V	5.90
6800uf 50V	5.20
2500uf 35V	1.95

RESISTORS

0.33W 1Ohm-10M in E24 Series. 03
1W 1Ohm-1M. in E12 Series 07
5W wirewound(E12) 0.1 Ohm-4.7K. 25
0.4W 2% 1Ohm-1M E12 Series 10

MINIATURE TRIMPOTS

100,250,500,1K,2K,5K, 10K,25K,50K,100K, 250K,500K,1M, all . . 20

Bi-Polar Electro. (all 50V)

1uf, 2.2uf	.25
3.3uf, 4.7uf	.30
6.8uf	.30
10uf, 22uf	.40
33uf	.50
47uf	.69
100uf	.80

Min. "Cermet" Trimpots Vert. & Horizontal. all 52

Polystyrene 125V

10,15,22,33,47,68,100, 150,220,330,390,470, 680pf. 45
1000,1500,2200,3300, 4700,6800,10000pf . 55

Computer Grade Electrolytic

2900uf 40V	6.75
6800uf 16V	6.48
10000uf 16V	9.00
10000uf 25V	9.72
10000uf 40V	13.50
15000uf 40V	12.06
22000uf 25V	14.22
22000uf 40V	23.40
27000uf 35V	24.48
33000uf 16V	13.50
68000uf 16V	22.32
100000 10V	22.32

POLYPROPOLENE (HIGH CURRENT)

0.015uf 630V	.30
0.047uf 400V	.40
0.056uf 400V	.40
0.47uf 200V	.90

Car Radio Suppress.

0.5uf(Gen)	1.00
3uf (Alt)	2.80
15Kohm(Dist)	.75
15Kohm(S/P)	1.10

R.I. Supp. for Elect. Appliances

0.1uf 630V 70

Edge Connectors, "Redline"

8 Way	1.10
16 Way	1.85
24 Way	2.95
32 Way	3.80

CABLE TIES

3½"	.06
5½"	.07

Enamelled Copper Wire (2&4 oz reels, B&S)

16,21,29	1.70
18,30	5.20
20,24	3.60
22	1.80
26	3.70
28	4.50
31	5.60
32	5.50
33,34	6.10
36,37	3.30
38,39,40	3.30

POTENTIOMETERS

Single Rotary Log or Linear	.70
Dual Rotary Log or Linear	1.60
Single Rotary with DPST switch	1.80
Slider Linear	1.10

MULTITURN TRIMPOTS

10,20,50,100,200,500, 5K,50K,500K,1M, 2M 1.45

AUDIO MODULES

S1-1010G 10W	10.80
S1-1020G 20W	21.90
S1-1030G 30W	27.75
S1-1050G 50W	42.38
HY5 stereo pre	33.00
HY50 25W	42.00
HY120 60W	95.00
HY200 100W	133.00
HY400 240W	180.00
SNR50 50W kit	36.00
SNR70 70W kit	46.00

IC SOCKETS

8 pin	.20
14 pin	.25
16 pin	.28
18 pin	.65

eti data sheet

ICM7216A Universal Counter, Drives Common Anode LED's
ICM7216B Universal Counter, Drives Common Cathode LED's
ICM7216C Frequency Counter, Drives Common Anode LED's
ICM7216D Frequency Counter, Drives Common Cathode LED's

FEATURES

ICM7216A AND B

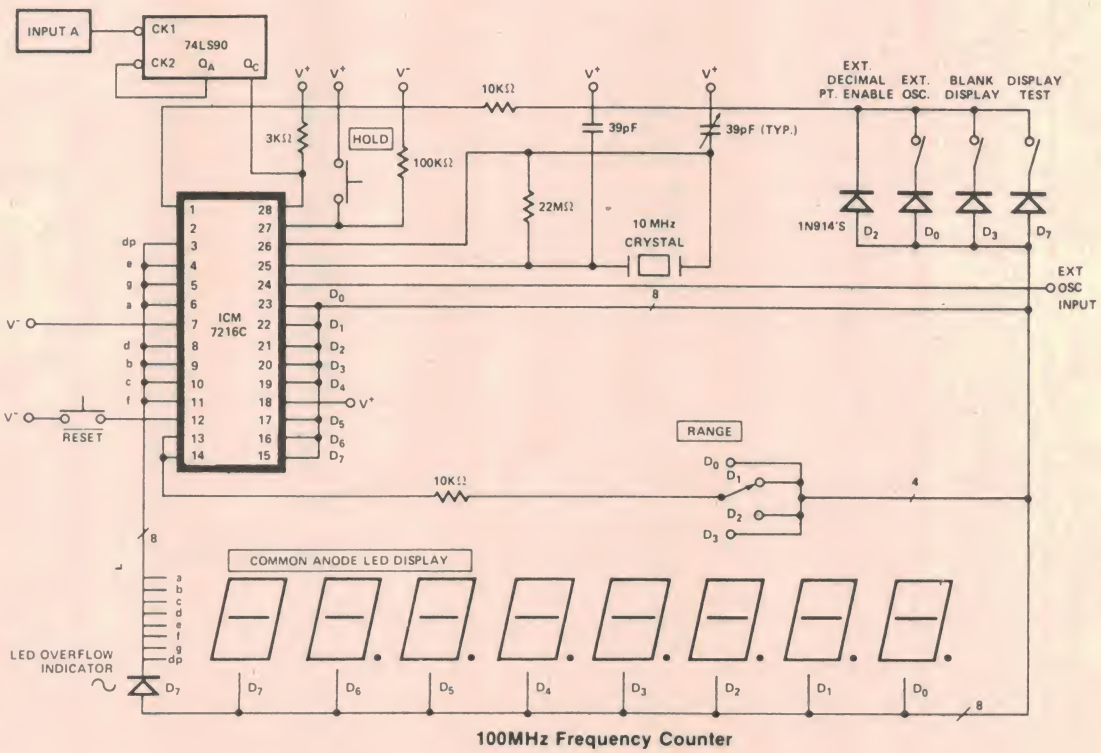
- Functions as a Frequency Counter, Period Counter, Unit Counter, Frequency Ratio Counter or Time Interval Counter
- Four Internal Gate Times:
  0.01 sec, 0.1 sec, 1 sec, 10 sec in Frequency Counter Mode
- 1 Cycle, 10 Cycles, 100 Cycles, 1000 Cycles in Period, Frequency Ratio and Time Interval Modes
- Measures Frequencies from DC to 10 MHz
- Measures Period from 0.5μ sec to 10 sec

ICM7216C AND D

- Functions as a Frequency Counter. Measures Frequencies from DC to 10 MHz
- Decimal Point and Leading Zero Blanking May be Externally Selected

ALL VERSIONS:

- Eight Digit Multiplexed LED Outputs
- Output Drivers will Directly Drive Both Digits and Segments of Large LED Displays. Both Common Anode and Common Cathode Versions are Available
- Single Nominal 5V Supply Required
- Stable High Frequency Oscillator, Uses Either 1 MHz or 10 MHz Crystal
- Internally Generated Multiplex Timing with Interdigit Blanking, Leading Zero Blanking and Overflow indication
- Decimal Point and Leading Zero Blanking Controlled Directly by the Chip
- Display Off Mode Turns Off Display and Puts Chip into Low Power Mode
- Hold and Reset Inputs for Additional Flexibility
- Test Speedup Function Included
- All Terminals Protected Against Static Discharge



100MHz Frequency Counter

INTERSIL ICM7216A/B/C/D

GENERAL DESCRIPTION

The ICM7216A and B are fully integrated Universal Counters and LED display drivers. They combine a high frequency oscillator, a decade timebase counter, an 8 decade data counter and latches, a 7 segment decoder, digit multiplexers and 8 segment and 8 digit drivers which can directly drive large LED displays. The counter inputs have a maximum frequency of 10 MHz in frequency and unit counter modes and 2 MHz in other modes. Both inputs are digital inputs. In many applications, amplification and level shifting will be required to obtain proper digital signals for these inputs.

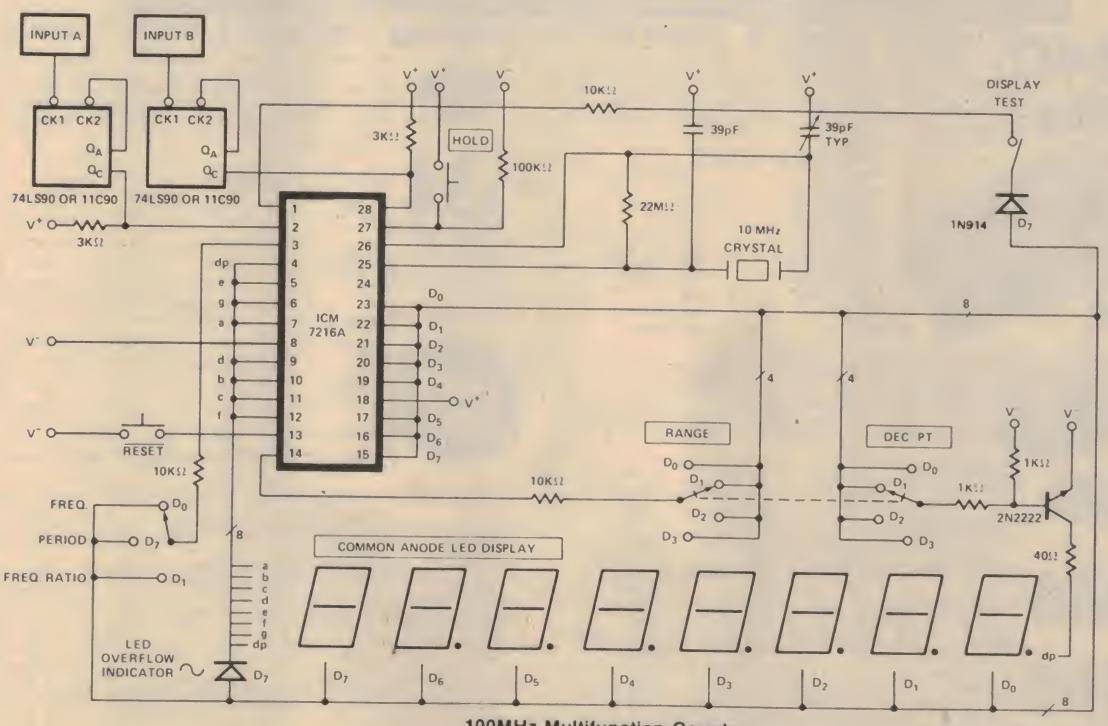
The ICM7216A and B can function as a frequency counter, period counter, frequency ratio (fA/fB) counter, time interval counter or as a totalizing counter. The counter uses either a 10 MHz or 1 MHz quartz crystal timebase. An external timebase input is also provided. For period and time interval, the 10 MHz timebase gives a 0.1 μsec resolution. In period average and time interval average, the resolution can be in the nanosecond range. In the frequency mode, the user can select accumulation times of 0.01 sec, 0.1 sec, 1 sec and 10 sec. With a 10 sec accumulation time, the frequency can be displayed to an accuracy of 0.1 Hz in the least significant digit. There is 0.2 seconds between measurements in all ranges.

The ICM7216C and D function as frequency counters only, as described above.

All versions of the ICM7216 incorporate leading zero blanking. Frequency is displayed in KHz. In the ICM7216A and B, time is displayed in μsec. The display is multiplexed at 500Hz with a 12.5% duty dycle for each digit. The ICM7216A and C are designed for common anode display with typical peak segment currents of 25mA. The ICM7216B and D are designed for common cathode displays with typical peak segment currents of 12mA. In the display off mode, both digit drivers and segment drivers are turned off enabling the display to be used for other functions.

ABSOLUTE MAXIMUM RATINGS

Maximum Supply Voltage ($V^+ - V^-$) . . . . . 6.5 Volts
Maximum Digit Output Current 400mA
Maximum Segment Output Current 60mA
Voltage On Any Input or
Output Terminal [1] . . . . . $V^+ + .3V$ to $V^- - .3V$
Maximum Power Dissipation at
70°C . . . . . 1.0 Watts (ICM7216A & C)
0.5 Watts (ICM7216B & D)



100MHz Multifunction Counter

MAD MAL

SUPER SCOOP!

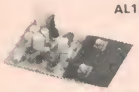
FIRST RELEASE

QUALITY AUDIO AMP MODULES

IT'S NEW

15-120 WATTS RMS

AL1540



15 WATT POWER AMPLIFIER

Providing 15 watts into 8 ohm loads, this versatile module makes an ideal basis for a quality sound system. It delivers its output power with less than 0.2% T.H.D. whilst its ability to withstand overload conditions make it suitable for many applications.

SPECIFICATIONS	
Output Power	15 Watts RMS
Supply	28 to 40 V
Load Impedance	8 to 16 ohms
T.H.D.	Less than .2% (Typically .1%)
Frequency Response	30 Hz to 25 kHz ± 2 dBs
Sensitivity	1.1D mV for full output
Max Heat Sink Temp	85°C
Dimensions	90 x 64 x 27 mm

$19.95

TRANSFORMER $10.65

AL2550

25 WATT POWER AMPLIFIER

This extremely compact 25 watt module is a popular choice for medium to high power applications. It features a typical distortion figure of 0.06%. Its low cost brings high fidelity performance within the reach of most budget conscious constructors, and as with all Autona modules, it is supplied with full installation instructions and specifications.

SPECIFICATIONS	
Output Power	28 Watts RMS
Supply	30 to 50 V
Load Impedance	8 to 16 ohms
T.H.D.	Less than .1% (Typically .06%)
Frequency Response	20 Hz to 30 kHz ± 2 dBs
Sensitivity	280 mV for full output
Max Heat Sink Temp	90°C
Dimensions	103 x 64 x 15 mm

$24.95

TRANSFORMER (unreg) $13.90 (reg) $31.50

AL5070

50 WATT POWER AMPLIFIER

We proudly present one of our most recent additions to the range. This 50 watt module with an incredibly low distortion figure of 0.02% comes complete with its own heatsink and load coupling components (capacitor and choke). It provides a superlative performance.

The fully protected circuitry was developed in Autona's development laboratory after many hours of critical listening tests, consequently we believe it is without equal in performance and value for money.

SPECIFICATIONS	
Output Power THD 1%	50 Watts RMS
Supply Voltage Max	70 Volts
Load	8-16 ohms
Frequency Response ± 1dB	26Hz – 20 kHz
Sensitivity for 50W into 8Ω	500 mV
Input Impedance	35 K ohms
T.H.D. up to clipping	.05% max. (Typically .02%)
S/N Ratio	100 dBs
Quiescent Current Drain	40 mA
S/C Complement	13 Transistors 5 Diodes
Dimensions	192 x 89 x 49 mm

$51.75

TRANSFORMER (unreg) $24.60 (reg) $31.5

AL12580

125 WATT POWER AMPLIFIER

This 125 watt module is at the top of the power range, and although it has been engineered to be one of the most rugged units available, it is still capable of providing high fidelity results with distortion levels down to 0.06%.

With a list of applications which include disco units, public address systems, electronic organs, and even domestic audio units, The AL12580 represents tremendous value for money, a fact which is confirmed by its large world wide sales.

SPECIFICATIONS		
Max. Output Power 4Ω		125 Watts RMS
Operating voltage		50-80 Max
Loads		4-16 ohms
Frequency response		25Hz-20kHz (100 watts)
Sensitivity for 100 watts		450mV
Input impedance		33k ohms
Typical T.H.D. @ 50 Watts	4 ohms load	0.1%
	8 ohms load	0.06%
S/N ratio		better than 80dBs
Semiconductor complement		13 transistors 5 diodes
Dimensions		205 x 190 x 38 mm

$59.95

TRANSFORMER (Unreg or Reg) mono $37.50 stereo $47.50

SPM 90/45 /65

STABILISED POWER SUPPLY

This module comprises a power supply stabiliser which is available in three voltages – 45 and 65 volts. The 45 volt unit is expressly designed to supply 2x AL2550 modules, whilst the 85 volt version is capable of operating 2x AL5070 or 1x AL12580.

The unit which is short circuit protected, provides a superior performance compared to the conventional unstabalized supply.

When ordering, the required voltage must be specified as follows — SPM90 45 or SPM90 65

SPECIFICATIONS	SPM90 45	SPM90 65
Output Voltage ± 5%	45 V	65 V
Max O.P. Current	2.5 A	2.5 A
Output Impedance	– Less than 0.1 ohms –	
Noise & Ripple at 2A	– Less than 15 mV –	
A.C. Input Voltage	40-48 V	60-65 V
Dimensions	– 149 x 83 x 37 mm –	
Required Reservoir Capacitor (100 VW)	2200uF	3300uF

$24.95

SA1240

12 + 12 STEREO CHASSIS

For application requiring greater output powers than are provided for by the SA73D. The SA124D should provide the answer. Offering all the advantages of a complete chassis, the unit provides a generous 12 watts per channel with low distortion typically 0.3%.

This unit provides an ideal basis for a home constructed high fidelity unit.

SPECIFICATIONS (Each channel)	
Output Power	12 watts RMS
Load Impedance	8 ohms
T.H.D.	Less than .5% (Typically .3%)
Frequency Response	50 Hz to 20 kHz ± 3 dBs
Tone Control Range	± 12 dBs at 100 Hz and 10 kHz
Sensitivity	170 mV for full output
Input Impedance	1 M ohms
A.C. Requirements	27 V A.C. rated at 1.5 A
Dimensions	200 x 130 x 33mm (Less controls)

$72

TRANSFORMER $10.65

SPA 25/SPA 25H

STEREO PRE-AMPLIFIER

A top quality stereo pre amplifier and tone control unit, the SPA 25 provides a comprehensive solution for the front end requirements of stereo amplifiers or audio units. The six push button selector switch gives a choice of inputs together with two filters for high and low frequencies.

A modified version of the unit, suitable for driving the AL 507D and AL 12580 is known as the SPA 25H.

SPECIFICATIONS	
Frequency Response	20 Hz to 20 kHz ± 1 dB
T.H.D.	Less than .1% (Typically .07%)
Sensitivity Inputs	
1 Tape	100 mV (1 MΩ) For an O.P. of
2 Radio Tuner	100 mV (1 MΩ) 250 mV (500
3 Magnetic P.U.	3.5 mV (50 KΩ) mV SPA 25H)
Bass Control Range	± 15 dBs at 75 Hz
Treble Control Range	± 10 20 dBs at 15 kHz
Signal/Noise Ratio	Better than 65 dBs (All inputs)
Supply	20 to 40 V (50 to 65 V SPA 25H)
Dimensions	300 x 90 x 33mm (Less controls)

$25

MPA 30

MAGNETIC CARTRIDGE PRE-AMPLIFIER

With the increasing popularity of magnetic cartridges the MPA 30 has been introduced as a means of providing the necessary equalization required by such cartridges. It is accurate to within 1dB of the RIAA characteristic. It is recommended for use with the SA 730 and SA1240 as well as other amplifiers units having a flat input characteristic.

SPECIFICATIONS	
Sensitivity	3.5 mV for 100 mV output
Equalisation	Within ± 1 dB from 20 Hz to 20kHz
Input Impedance	50 K ohms
Supply	20 to 30 V
Dimensions	110 x 50 x 25mm (Inc. DIN socket)

$15.99

Quality audio modules and accessories for Professionals and Enthusiasts

25-240 Watts!

HYBRID POWER AMPLIFIER

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. Over the years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the world. The device is terminated with five connections: Input, Output, Power Lines and Earth.

HY50
25 Watts into 8Ω
$44

TECHNICAL SPECIFICATIONS		
Output Power	:	25 Watts RMS into 8Ω
Load Impedance	:	4 – 16Ω
Input Sensitivity	:	500mV
Input Impedance	:	100KΩ
Distortion	:	0.04% at 25 watts at 1kHz
Signal/Noise Ratio	:	Better than 75dB
Frequency Response	:	10Hz – 45kHz –3dB
Supply Voltage	:	–25 –0– +25 Volts
Size	:	105 x 50 x 25mm
Weight	:	155 grammes

NO EXTRA HEAT SINK NECESSARY
EXTRA RUGGED CONSTRUCTION
PROFESSIONAL FINISH
SHORT/OPEN PROTECTION

The HY120, HY200 and HY400 are high fidelity hybrid amplifiers incorporating three internal protective safeguards (short circuit, open circuit and thermal cutout) making these amplifiers practically indestructible in virtually all fields of use. The low distortion, high signal to noise ratio, large bandwidth and general robustness of the amplifiers render them ideal for any application from Hi Fi, discotheque to industrial use.

SPECIFICATIONS	60 Watts	120 Watts	240 Watts
Output Power	60 watts RMS into 8Ω	120 watts RMS into 8Ω	240 watts RMS into 4Ω
Load Impedance	4 – 16Ω	4 – 16Ω	4 – 16Ω
Input Sensitivity & Impedance	500mV RMS into 100KΩ	500mV RMS into 100KΩ	500mV RMS into 100KΩ
Distortion	0.04% typical at 1kHz	0.05% typical at 1kHz	0.1% typical at 1kHz
Signal to Noise Ratio	Better than 90dB	Better than 96dB	Better than 94dB
Frequency Response	10Hz to 45kHz –3dB	10Hz to 45kHz –3dB	10Hz to 45kHz –3dB
Power Supply Voltage	Volts –35 –0– +35	–45 –0– +45 Volts	–45 –0– +45 Volts
Dimensions and Weights	114 x 50 x 85mm 575 grammes	114 x 50 x 85mm 575 grammes	114 x 100 x 85mm 1.150 kilogrammes

HY120
60 Watts into 8Ω
$99

HY200
120 Watts into 8Ω
$139

HY400
240 Watts into 4Ω
$188

HYBRID PREAMPLIFIER HY 5

The HY5 is a mono Hybrid amplifier ideally suited for all applications. All common input functions (magnetic pickup, cartridge, tuner, etc...) are catered for internally, the desired function is achieved either by a multi way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). To ease construction and mounting a P.C. connector is supplied with each preamplifier.

$34

HY5 PRE-AMPLIFIER
Compatible with all I.L.P. power amps. and P.S.U.'s. In a single pack, needs external pots and switches. Multi-function equalization. 5 inputs. High overload margin. Active tone controls, 500 mV out. Distortion at 1 KHz – 0.01%.
Two connect easily for stereo.

TECHNICAL SPECIFICATION		
INPUTS:	Magnetic Pickup	3mV R.I.A.A.
	Ceramic Pickup	30mV
	Microphone	10mV
	Tuner	100mV
	Auxiliary	3 – 100mV
	Input Impedance 47KΩ at 1kHz on all inputs except the Ceramic.	
OUTPUTS.	Tape	100mV RMS
	Main Output	500mV RMS
TONE CONTROLS:	Bass	± 12dB at 100Hz
	Treble	± 12dB at 10kHz
DISTORTION:	0.01% at 1kHz	
SIGNAL/NOISE RATIO.	Better than 68dB on most sensitive input	
POWER SUPPLY:	Split line ± 16 volts to ± 50 volts at 15mAmps	

SPECIAL OFFERS

NOTES:

For normal conditions and usage these amplifiers need no supplementary heatsink; they must however be mounted to allow a vertical flow of air through the fins.

The amplifiers must be powered from a true split line (symmetrical) supply and under no circumstances should an attempt be made to use a single line.

A quick blow fuse must be mounted between the output terminal and the loudspeaker.

No input capacitor is required owing to an internal capacitor of 250 volts working.

The thermal shutdown operates at 70°C and will automatically reset when the heatsink has cooled by 10°C. Under normal operating conditions the heatsink should be between 30° – 60°C, depending on the type of signal.

HY50 TRANSFORMER $13.90
HY120 TRANSFORMER $31.50
HY200 TRANSFORMER mono $37.50 stereo $47.50
HY400 TRANSFORMER mono $47.50 stereo $47.50x2

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*Excluding case. Sales Tax add 15 percent. Quantity discounts available.

8020A. Compare the performance features with any other DMM in it's price range and you'll see the 8020A ranks with multimeters costing much more. 0.1 percent basic dc accuracy, 6 functions, 26 ranges, unique conductance function, in-circuit resistance and diode test. All this for $179*. Measure resistance to 10,000M ohms — ideal for verifying resistance of H.V. dividers, checking capacitor leakage, PCB's, cables and insulators. Also measure transistor beta with a simple adaptor. Measure resistors and diodes in circuit. Diode Test ranges supply enough voltage to turn on silicon junctions, whereas Low Power ohms ranges ignore these devices.

FLUKE®

8022A
$145.00*

*Excluding case. Sales Tax add 15 percent. Quantity discounts available.

8022A. If you do not need to measure resistances higher than 20M ohms, then the 8022A is your DMM. It's a real pocket-size performer — measures dc volts, ac volts, ac and dc current and resistance with a basic dc accuracy of 0.25 percent in all six functions, 24 ranges. For just $145*.

Overload Protection. Both the 8020A and the 8022A offer 500V dc protection on resistance ranges, 1000 V on voltage, 2A on current ranges and over 6 kV transient protection.
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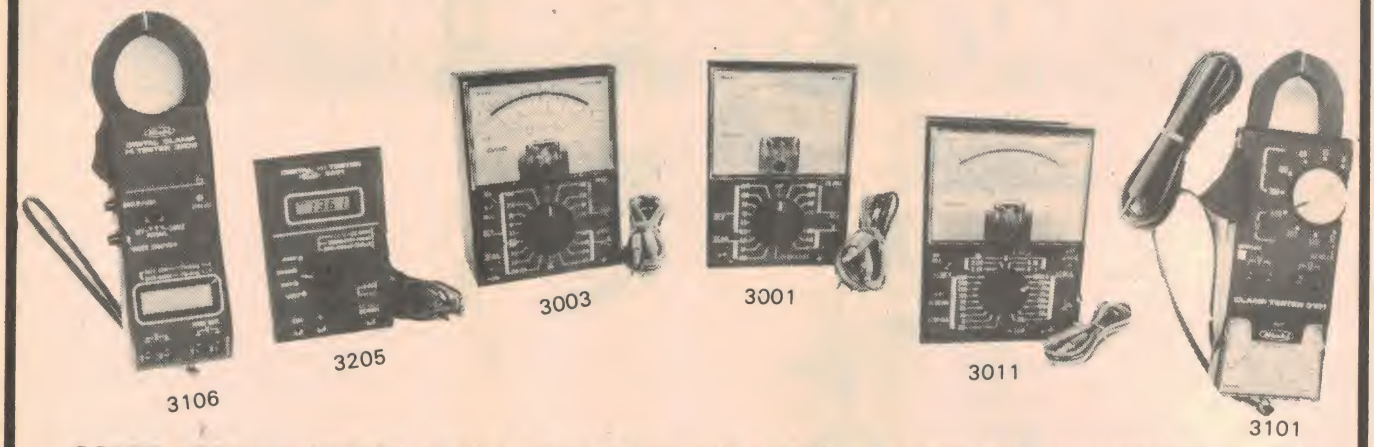

BRIEF SPECIFICATIONS FOR SOME POPULAR MODELS FROM THE EXTENSIVE HIOKI RANGE OF TAUT BAND ANALOGUE AND DIGITAL INSTRUMENTS

SPECIFICATIONS

3001 TESTER FOR APPLIANCES AND GENERAL HOUSEHOLD
0.25/2.5/10/50/250/1000V DC 2kΩ/V ±3%
0.5/10/250mA DC ±3%
10/50/250/1000V AC 2kΩ/V ±3%
3k/30k/300k ±3%F.S. R.C. 26Ω

3002 PRACTICAL COMPACT TESTER
0.5/2.5/10/50/250/1000V DC 20kΩ/V ±3%
50 A/25/250mA ±3%
10/50/250/500/1000V AC 9k /V ±3%
10k/100k/1M ±3%F.S. R.C.100Ω
L.F. Output —20 to +36dB ±4%

3003 PRACTICAL MEDIUM CLASS TESTER
0.25/2.5/10/50/250/1000V DC 30kΩ/V ±3%
50μ A/2.5/25/250mA/10A DC ±3%
10/50/250/1000V AC 13.5kΩ/V ±3%
10A AC ±4%
5k/50k/500k/5M ±3%F.S. R.C.50Ω
L.F. Output —20 to +36dB ±4%

3005 HIGH CLASS TESTER WITH RELAY PROTECTION
0.25/1/2.5/10/50/250/1000V DC 50kΩ/V ±3%
50uA/2.5/5/50/500mA/10A DC ±3%
10/50/250/1000V AC 10kΩ/V ±3%
10A AC ±4%
2k/20k/200k/2M ±3%F.S. R.C.20Ω
L.F. Output —20 to +36dB

3010 HIGH SENSITIVITY (10μ A OPERATING CURRENT) TESTER WITH RELAY PROTECTION
0.1/1/2.5/10/50/250/500/1000V DC 1000kΩ/V ±3%
10 A/100μ A/1/10/100/500mA/10A ±3%
10/50/250/500/1000V AC 10kΩ/V ±3%
10A AC ±4%
2k/200k/2M/20M ±3%F.S. R.C.20Ω
L.F. Output —20 to +36dB

3011 HIGH CLASS WIDE RANGE TESTER FEATURING ELECTRONIC RELAY PROTECTION
2.5/5/10/25/50/100/250/500/1000V DC 40kΩ/V ±2%
25μ /50μ /100μ /250/2.5m/25m/250m/2.5A/10A DC ±2%
2.5/5/10/25/50/100/250/500/1000V AC 10kΩ/V ±3%
25μ /50μ /100μ /250μ /2.5m/25m/250mA/2.5A/10A AC ±3%
3k/30k/300k/3M ±2%F.S. R.C.20Ω
L.F. Output —20 to +36kB

3205 DIGITAL MULTITESTER SEMI AUTO RANGING WITH FE-LIQUID CRYSTAL DISPLAY AND HIGH ACCURACY
DC V 0-200mV/2000mV/20V/200V/1000V 10MΩ
AC V 0-200mV/2000mV/20V/200V/1000V 10MΩ
Ω 0-200/2000/20k/200k/2M/20M
DC A 0-200μ A/2000μ A/20mA/200mA
AC A 0-200μ A/2000μ A/20mA/200mA

3101 CLAMP TESTER WITH CONVENIENT METER LOCK
6/15/60/150/300A AC ±4%
150/300/600V AC 2kΩ/V ±3%
0-1kΩ (Centre 30Ω) ±3%F.S.

3206 DIGITAL CLAMP TESTER TO 1000A AND FE-LCD FEATURES READING HOLD FACILITY AND SURGE HOLD FOR MOTOR START READINGS. SPECIAL 0-20A RANGE PROVIDES 0.01A RESOLUTION.
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Shoparound

NOT ALL of our projects are, or for that matter can be, designed here in our own laboratory at ETI. In the case of this month's lead project, the **ETI-680 Z80 S100 microprocessor board**, the cost of designing such a major piece of equipment — and the time involved, would stretch our capacity and resources rather too much for comfort. Rather than not present such a project — and we realised some time ago the sort of demand there was — we have accepted a design from David Griffiths, whom most of you into the hobby computing side of electronics will be familiar through his VDU design — project ETI-640 (remember — the issue with Roger Harrison in German officer's uniform on the cover!).

Considering the considerable investment in the design effort required to produce the ETI-680, it is only natural that the designer should be entitled to some compensation for his work. For this reason, the copyright on the pc board design and Monitor program in ROM has been retained by David Griffiths/Microworld. The pc board pattern cannot be reproduced in any form, for sale, without written permission — details are given in the article.

Normally, this would mean that all kits for this project would have to come from the designer. This would be a very unsatisfactory arrangement as the project would then be little more than a favoured review of someone's product. The condition under which we published this project was that the pc board and Monitor ROM would be available at trade prices to any supplier wishing to kit up for this project and that a high quality copy of the pc board pattern would be made available to private individuals, purely for their own use (although, admittedly few would be able to reproduce their own board as it is very complex and requires precision alignment and etching).

Accordingly, David has made arrangements for ready-made pc boards, the Monitor ROM and an instruction manual (with considerably more detail than it would be possible for us to include in an article) to be available — both trade and retail — through:

Applied Technology
1A Patterson Ave
Waitara NSW 2077

We understand complete kits, with all ICs and an instruction manual, will be available through Applied Technology (in Sydney) and Silicon Valley stores around Australia. Protronics in Adelaide have indicated they will be supplying parts. Other suppliers have shown interest and the project may be more widely available in due course.

As a private constructor, if you wish to tackle the manufacture of your own board (you hardy, adventurous soul), a print of the artwork is available, free of charge, by sending a large SAE to:

ETI-680 pc artwork
Electronics Today magazine
15 Boundary St
Rushcutters Bay NSW 2011

Now that the subject of pc boards has been raised, you may be interested in a system which makes it quite an easy task to **produce good quality pc boards in the home workshop.**

Jasray Enterprises, of 15 Francis St, Saint Agnes SA 5097, sell a range of Riston pre-coated printed circuit board. These have the photoresist — a photosensitive polymer sheet — factory-coated onto the copper of the blank pc board. Jasray has boards in sizes ranging from 150 mm square up to 450 mm x 300 mm, in both single and double-sided sheets. A 300 mm square sheet of single-sided board, for example costs $7.20, double-sided, $9.51. These prices are not much more than the retail price of uncoated fibreglass blanks and our experience has shown that this pre-coated board is virtually foolproof to use, giving excellent results almost every time — there is very little wastage.

Jasray also has available Scotchcal products in single or part sheets — very appealing to the constructor who cannot justify the expense of buying a whole box. Not only that, but they also stock a plastic grid sheet, ruled with a 0.1" grid, for laying artwork. Big deal, you say — but this one's different! The sheet and grid are transparent to UV light allowing the artwork to be assembled on the sheet and a negative (Scotchcal or standard film) can be made by the usual exposure method. Cunning, what?

Jasray soon hope to have a range of artwork drafting aids, such as pads, tapes etc and a small drafting board. Good stuff for the serious home constructor or small electronics business.

That (seemingly) crazy **crystal** specified in the **Tuning Fork** project is a standard NTSC (yep — no mistake) chrominance subcarrier crystal. We have seen them in the occasional television replacement components supplier and surplus components stores for a few dollars. Have a root around in your junk box — you haven't got one!? Maybe we should write an article on how to generate a junk box. Back to the crystal — we rang quite a number of suppliers who indicated it was a stock item, so no difficulty should be experienced in obtaining one.

Designed as an accessory to our Series 4000 amplifier, the **Moving Coil Cartridge Preamp** is probably one of the most notable designs to come out of the magazine this year. Performance equals or surpasses the best commercial units. The complete kit will be available from **All Electronic Components,** 118 Lonsdale St Melbourne, and **Jaycar,** 380 Sussex St, Sydney.

Each month we send **pc board artwork** out to a number of pc board manufacturers and component suppliers. The artwork is sent out before the magazine hits the streets to give suppliers a chance to get boards for the current month — *fairies at the bottom of the darkroom and Australia Post willing!*

The following firms subscribe to the scheme

Applied Technology, Hornsby
RCS Radio, Bexley NSW
Rod Irving Electronics, Northcote Vic
James Photronics, Fulham Gardens SA
Jemal Products, Victoria Park WA
Mini Tech, Auckland NZ

In addition, the following suppliers indicate they stock, or can supply on order, most of the pc boards we have done:

Radio Despatch Service, Broadway NSW
All Electronic Components, Melbourne Vic
Rod Irving Electronics, Northcote Vic
Tasman Electronics, Coburg Vic
Willis Trading, Perth WA

Suppliers, if you wish to be included in this list — which we will run occasionally in Shoparound please let us know. Write or phone the Project Manager, Phil Wait.

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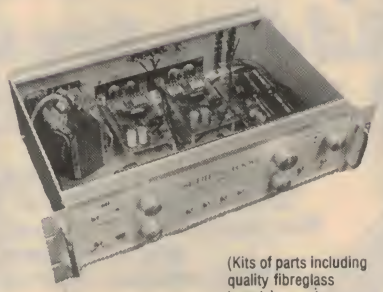

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- ETI 480 kit of parts 100w (incl. bracket).....19.75
- ETI 470 PS kit of parts.....19.50 (includes relay, not transformer)
- Transformer to suit 22.90
- ETI 471 pre-amp 45.50
- ETI 585R ultra sonic RX 15.95
- ETI 585T ultra sonic TX 8.95
- EA 79 SF9 sound flash trigger.....15.00
- All parts available for DREAM computer project.
- P.C.B.'S (all quality fibreglass boards)
  ETI 574 disco strobe.....2.80
  ETI 549A metal detector.....2.75
  DREAM circuit board.....9.90

Project Boards (Fibreglass)

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ETI 072	1.80	ETI 581	2.20
ETI 081	1.50	ETI 583	2.20
ETI 083	1.80	ETI 585R	1.60
ETI 084	1.70	ETI 585T	1.40
ETI 085	1.30	ETI 586	2.30
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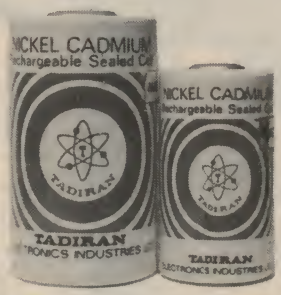

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While energy authorities throughout the world are spending large sums developing windmills to produce power from wind near ground levels, two researchers from the University of Sydney's Department of Mechanical Engineering are designing windmills to operate 10.4 km up in the stratosphere.

THE WINDMILLS would be built into large gliders, tethered to the ground by a cable made of Kevlar, a plastic based material with twice the strength/weight ratio of nylon. Kevlar has been developed in the United States over the past eight years and had been used for applications deep on the ocean floor.

Associate Professor Brian Roberts and Dr Clive Fletcher say that at 10 670 metres the jetstreams above Australia can supply about 3000 times more energy than is available at ground level.

(The jetstreams are massive convective currents produced by the earth's spin and the difference in the sun's heating at the poles and at the equator. They exist in the northern and southern hemisphere at roughly 30 degrees latitude).

"Ground-based windmills are severely hampered by the low power density of wind near the ground and by its great variability in time and space," said Professor Roberts.

"Our studies over the past two years have indicated that tethered gliders in the stratosphere could generate electricity at a cost of two cents a kilowatt or even less," said Dr Fletcher.

"This is competitive with the cost of power produced by conventional coal-burning power stations in Australia."

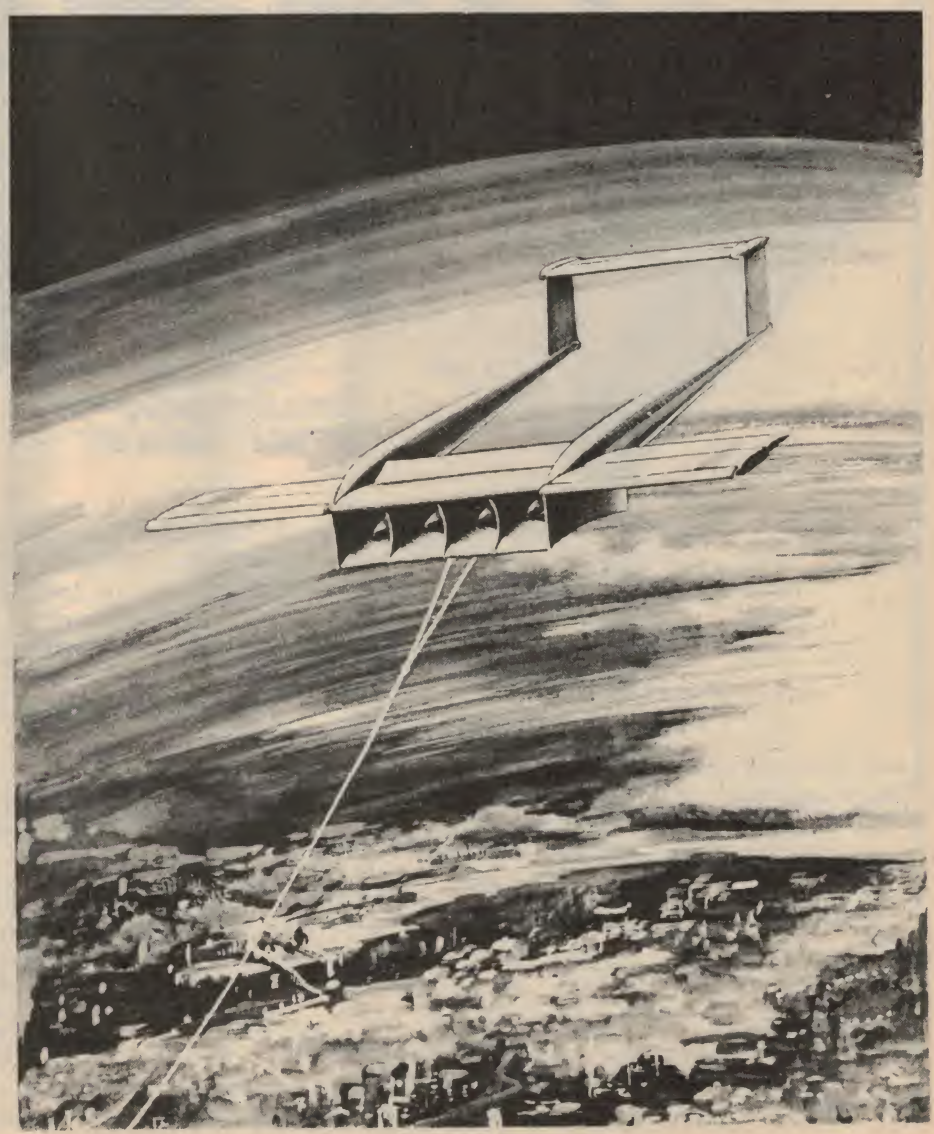
The National Energy Research Development and Demonstration Council (NERDDC) recently made a grant of $24 000 for an initial feasibility study with wind tunnel testing.

Tests with a model should take about three months, after which the next logical step will be tests with low-level models in the atmosphere.

"We expect it to take 18 months to two years to gather enough information to lay down the fairly detailed specifications for a one-megawatt prototype, subject to funding," said Professor Roberts.

A prototype one-megawatt aerodynamic platform would have a wingspan of 35 to 40 metres and would produce enough power to supply approximately 1200 homes. Its weight would be approximately 3000 kilograms (about 3 tonnes), and it would have perhaps four turbines of about five metres in diameter, the eventual configuration depending on wind tunnel tests.

Because of the high energy density available in the jetstream over Australia (20 kilowatts per square metre) this project is especially suited to Australian conditions. ●



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Contents include: Audio Level Meter, Impedance Meter, Audio Millivoltmeter, Simple Frequency Counter, Phase Meter, Temperature Meter, Audio Signal Generator, Audio Noise Generator, and many more.

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● ETI Circuits No. 2

This giant compendium of circuits has been assembled from the 'Ideas for Experimenters' section of Electronics Today and is packed full of ideas and suggestions for the experimenter. The chapter headings cover Alarms, Amplifiers, Automobile, Batteries, Comparators, Conversion Tables, Crossovers, Crystal Oscillators, Detectors, Digital, Filters and so on. Whenever you're looking for a circuit, this is the book to turn to.

Price: $2.95 plus 45 cents post and packing.

● 30 Audio Projects

For the Audiophile who wants good sound at a good price plus the satisfaction of having built it himself, 30 Audio Projects is required reading. The contents include our most popular audio projects: 25 watt Amp, General Purpose Preamp, Bucket Brigade Delay Line, Active Crossover, Compressor Expander, Tape Noise Limiter, Transmission Line Speaker System, Master Mixer, Graphic Equalizer and the 50/100 Watt Amp Modules.

Price: $3.95 plus 70 cents postage and packing in NSW (80 cents in other states).

● Project Electronics

Specially designed to meet the needs of newcomers to electronics, and in particular school students following the three-segment Industrial Arts syllabus in electronics, this book has been a runaway success! Twenty-six projects (many easily available in kit form) are completely described along with hints on troubleshooting, components, how to solder, etc. None of the projects is expensive and all are satisfying to build.

Available in newsagents, component stores or directly from ETI.

Price: $4.75 plus 45 cents post and packing.

● International 3600 and 4600 Synthesizers

A completely revised and updated reprint of ETI's phenomenally successful music synthesizer designs.

This book has been beautifully printed on heavy art paper and has a sturdy cover varnished for protection.

Available from some kit suppliers.

Price: $12.50 including post and packing.

● Top Projects Vol. 4

Available from newsagents or directly from Electronics Today International this book, published in June 1977, contains the following projects: Audio Expander/Compressor, 50/100 Watt Amp Modules, Stereo Amplifier, Dynamic Noise Filter, Audio Phaser, Audio Limiter, TV Game, Swimming Pool Alarm, Temperature Alarm, Active Antenna, GSR Monitor, Universal Timer, Mini-Organ, GP Power Supply, Temperature Meter, Train Controller, Car 'Scope Testing.

Price: $3.00 plus 45 cents postage and packing.

● Simple Projects Vol. 2

A collection of some of our most popular, less complex projects. Includes: Induction Balance Metal Detector, Train Controller, Telephone Bell Extender, Photographic Strobe, Transistor Tester, Selecta-game, Breakdown Beacon, Simple Loudness Control, Speed Controller, Three Simple Receivers, One-transistor Radio, Mini-organ, Accentuated Beat Metronome, Active Antenna, Simple Intercoms, as well as constructional information, and lots of helpful data on component markings and values.

Available from newsagents or directly from ETI.

Price: $2.95 plus 45 cents post and packing.

● Top Projects Vol. 5

Once again, this 'Best of ETI' publication is available from many newsagents or directly from ETI. Published in 1978 it is crammed with projects: Shutter Speed Timer, Ultrasonic Switch, Accentuated Beat Metronome, Marine Gas Alarm, House Alarm, White Line Follower, Induction Balance Metal Detector, Photographic Strobe, Simple Compressor/expander and CB Power Supply.

Price: $3.00 plus 45 cents post and packing.

commodore

the PET computer

The Pet has a television screen, a keyboard as simple to use as a typewriter and a self-contained cassette recorder which is the source for programmes and for storing data in connection with these programmes. And it has, in its standard configuration, an 8K user memory. (This is in addition to the 14K operating system resident in the computer).

SPECIAL AT NO EXTRA COST

$200 value of programmes will be provided with each PET purchased prior to December, 31st, 1979.

2001-16/32

The CBM Computer is now a truly sophisticated Business System with the announcement of these Peripherals.

The CBM incorporated with the Floppy Disk and Printer makes an ideal business system for most professional and specialized fields, medicine, law, dental, research, engineering, toolmaking, printing, education, energy conseration etc . . . The CBM Business System as a management tool, delivers information to all levels of Business previously attainable only with equipment many times more expensive, the CBM Business system is one of the most cost efficient business tools today. It offers a wide range of applications from logging management strategy in major corporations to organizing accounts and inventory control of small businesses. Here are just a few of the cost saving uses in the corporation, professional office or small business stock control, purchasing, forecasting, manufacturing,costing, customer records, mailing list, etc. The CBM Floopy Disk and Printer, a compatible business system at a reasonable price — Take a closer look at these Peripherals.

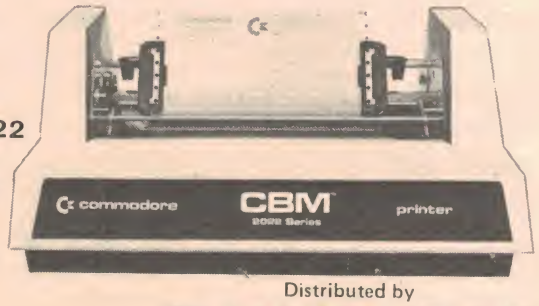
2040

Dual Drive Floppy Disk

The Dual Drive Floppy is the latest in Disk technology with extremely large storage capability and excellent file management. As the Commodore disk is an "intelligent" peripheral, it uses none of the RAM (user) memory of the CBM The Floppy Disk operating system used with the CBM computer enables a programme to read or write data in the background while simultaneously transferring data over the IEEE to the CBM The Floppy Disk is a reliable low cost unit, and is convenient for high speed data transfer. Due to the latest technological advances incorporated in this disk, a total of 340K bytes are available in the two standard 5¼" disks, without the problems of double tracking or double density. This is achieved by the use of two microprocessors and memory I.C.s built into the disk unit. Only two connections are necessary — an A/C cord and CBM interface cord.

Tractor Feed Printer

2022



The Tractor Feed Printer is a high specification printer that can print onto paper (multiple copies) all the CBM characters — letters (upper and lower case), numbers and graphics available In the CBM The tractor feed capability has the advantage of accepting mailing labels, using standard preprinted forms (customized), cheque printing for salaries, payables, etc. Again, the only connections required are an A/C cord and CBM connecting cord. The CBM is programmable, allowing the printer to format print for: width, decimal position, leading and trailing zero's, left margin justified, lines per page, etc. It accepts 8½" paper giving up to four copies. Bidirectional printing enables increased speed of printing.

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Print-out

Ohio Scientific C4P MF

The new Ohio Scientific C4P MF is targeted to both personal computer users as well as educational, scientific and other professional applications.

Featuring a 32 x 64 character display with 16 colours and a graphics resolution of 256 x 512 points, the C4P MF comes complete with a minifloppy and 24 K of static RAM. It can be expanded to 48K and two minifloppies.

Other features include a line printer interface, modem interface, a full keyboard with lower case and advanced disk-based software including an information management system, word processor and a library of software development tools. And that's not all: there's also sound output, a D/A converter for music and voice output, joystick interfaces, a real time clock, and other stuff too numerous to mention.

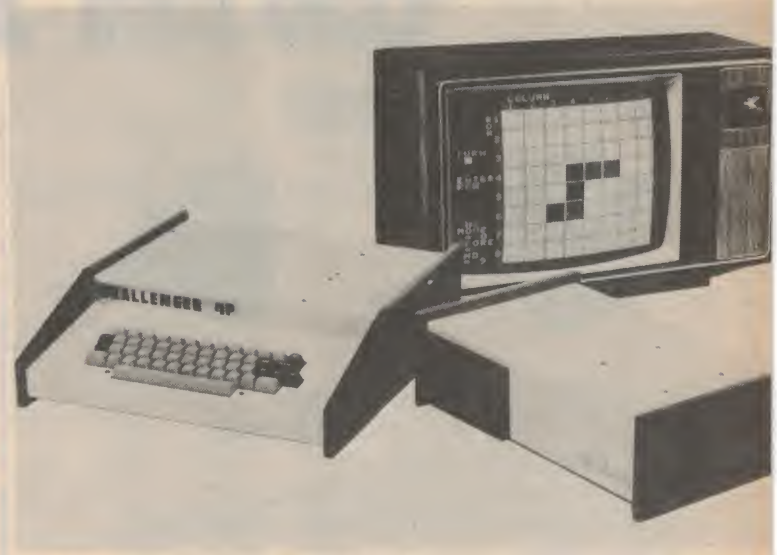
Did I miss anything?

What's more, if I've read the press release right, all this comes in a 31 kg package with a suggested retail price, in the US, of US $1695.

Frankly, this all seems too good to be true, but I've got it all here written down in black and white.

For further details, contact Ohio Scientific's local agent, TCG Systems Automation Pty Ltd, 26 Clarke St, Crows Nest NSW 2065. Tel: (02) 439-6477

But a word of warning; don't expect it to be available in Australia for some time to come — if that price is right, Ohio won't be able to keep up with the demand in the States, let alone the rest of the world!



Ohio Scientific' latest offering — the C4P MF.

Calc has Cassette Interface

A new programmable calculator from Casio has a novel form of off-line storage — a plug-in casette interface.

The FX502P has 256 steps of program memory and 22 data registers, in CMOS, so they retain their contents when the machine is turned off. The 'language' is algebraic, with parentheses nested to 10 levels, and it provides all the usual conditional jumping, branching looping, testing, etc. that one expects in a programmable calculator.

The FX-502P is claimed to operate at very high speed ('amazing', according to the brochure we have!), and has a couple of interesting features. The keyboard can be used to play music, and it can even replay under program control, making it probably the world's smallest (and oddest) sequencable music synthesizer!

This feature operates through the accessory tape interface, model FA-1, which can also (obviously) be used to save and reload programs and data.

For further details on the FX-502P, and its less powerful brother, the FX-501P, contact Electronic Calculator Discounts, P.O. Box 106, Baulkham Hills NSW 2153. Tel: (02) 624-8849.

SSM PB1 2708/2716 EPROM programmer and EPROM board

Solid State Music ('The blue boards') have quite an interesting line-up of boards, including their music synthesizer and the one discussed here, the PB1 2708/2716 Programmer and 4K/8K EPROM board.

The PB1 has two sockets into which the user can insert either a 2708 or a 2716, and by running a suitable program, copy the contents of a 1K or 2K block of memory into the EPROM. In addition, there are four sockets which can accept 2708s or 2716s for permanent inclusion in a system, carrying a system monitor or assembler, for example.

The board (S-100, of course), generates the necessary programming voltage on-board using a TL497 switched-mode power supply chip, so that no external power supply is necessary.

The programming sockets, which can be (optionally) Textool zero insertion force sockets, are memory mapped to any 4K byte boundary and timing for the programmer is supplied by on-board monostables, not software timing loops, thus simplifying the driver software. A LED indicates selection of the programming mode, and there is a switch on the programming voltage, avoiding the problems of accidental programming.

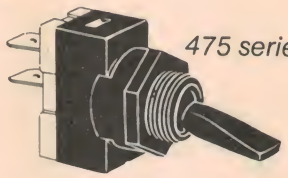
On the read-only, as opposed to the programming side, the EPROM sockets can be set to any 4K boundary above 8000H (200:000Q). This is a bit of a problem, as many programs are written to reside in the first 32K of memory, and hence cannot be used with this board; however, the bulk of assemblers and monitor programs live at the top end of memory and so are perfectly usable.

The unused EPROM sockets do not enable the data bus drivers if no ICs are inserted in them so that the board is not committed to the full complement of memory. Wait state generation circuitry on the board allows the use of slow ROMs with up to four wait states.

If you have any large programs which you use frequently or which you need in your system permanently, then this board may well suit your needs. For further information, contact Stewart Electronics, 33 Sunhill Road, Mt Waverley Vic 3149. (03) 277-0622. ▶

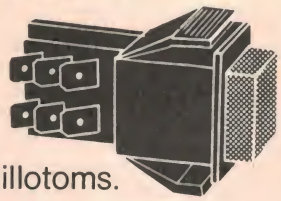
YOU'RE IN CONTROL WITH SWANN

TOGGLE SWITCHES



- Single pole / Double pole.
- Current rating - up to 15 amps.
- Voltage 250V AC.
- Temp rating - up to 105°C.
- Terminals - 6.3 mm tabs, screw or solder tail.
- Many different levers available.

80 SERIES - PUSH BUTTON SWITCH



Specifications
Current - up to 16 amp.
Voltage - 250V AC.
Temp rating - up to 85°C.
Contact resistance - <5 millotoms.
Terminals - 6.3 mm tabs.

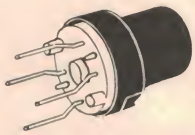
Features
- Snap mounting.
- High current performance.
- Self-cleaning switching action.
- Push/push or momentary action.
- Buttons can be hot-stamped.

82 SERIES - ROCKER

Single pole / double pole.
Current - up to 16 amps.
Temp rate - up to 105°C.
Voltage - 250V AC.
Terminals - 6.3 mm tabs, screw or solder tail.

82 SERIES THE VERSATILE ROCKER SWITCH

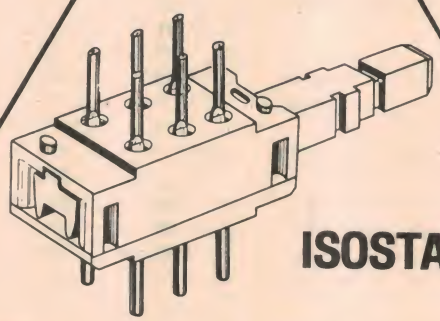
D6 - THE KEY SWITCH



The D6 is a single pole, single throw normally open key switch specially designed for electronic control.

Features
- High temp rating.
- Self clean contacts.
- Strapped terminals.
- Snap in.
- Contact resistance <100 m Ω

For the full list of features and applications of the D6 - call us today.



ISOSTAT

There are:—
—4 types of block having 2,4,6 or 8 poles (B.B.M.).
—4 different mechanical functions are available: momentary, push/push, interlocking and release (only available for block contact and blocks with 2 or 4 poles).

Swann Electronics International, Cnr. Forster & Hardner Roads, Mt. Waverly, Vic., 3149. P.O. Box 350, Phone (03) 544 3033.

219 Blaxland Road, Ryde, N.S.W., 2112, P.O. Box 184, Phone (02) 807 1944.
5 King William Street, Kent Town, S.A., 5067, Phone (08) 42 6664.
Takapuna, Auckland, New Zealand. Also U.K. and Singapore.

Printout

S-100 Rides Again

Just when the PET pundits and the TRS-80 trendies were saying that S-100 is dead, it turns the tables on them again. The publication of IEEE Task 696.1/D2, Proposed Standard for the S-100 Bus, seems to have breathed new life into the old girl, and with a flash of her petticoats, she's off and flirting with 16-bit processors, multi-processor systems and the like!

At least two 8086-based boards are now available, one from Seattle Computer Products, whose 16K RAM Card was reviewed in this column some time back, and one from California Digital.

A processor Card based on the TMS9900 has been available for some time, from Marinchip systems, and this has comprehensive software support, including Pascal for only $150. Also in the pipeline are several CPUs based on the Z-8000.

The way S-100 has been extended to cope with 16-bit machines is interesting, as it also allows the use of 8-bit memory and peripherals. When a 16-bit master prepares to transfer data to or from memory or an I/O port, it pulls the SXTRQ line low (are you a 16-bit device?), and a 16-bit device will respond by pulling the SIXTN line low, while an 8-bit device will simply ignore it.

16-bit bus master to 16-bit bus slave transfers are accomplished by paralleling the data out (DO) and data in (DI) buses into one 16-bit bidirectional data bus. This gives maximum transfer speed. If the master addresses an 8-bit device, then the DO and DI busses operate in the conventional way, with a 16-bit value being transferred as two bytes one after the other.

As well as extending the data bus to 16 bits, the standard uses spare lines to extend the address bus to 24 bits, allowing direct addressing of up to 16 Mbytes. Additionally, protocol has been specified to allow multiple processor or bus masters to operate on the bus, and some of the other lines (such as Phantom) have been standardised.

Other goodies coming up for S-100 include an 8088 CPU rumoured to be coming from Thinker Toys. The 8088 is a version of the 8086 which has an 8-bit bus to the outside world, yet operates the same way internally. The board is also rumoured to have a memory management unit.

Also coming from Thinker Toys is a hard disk unit — more details on that when we have them, but for now, we are told the price will be under $5000.

For long-time 6800 fans: the 6809 (vastly superior to 6800) is available for the S-100 bus from a US Company called Microdasys. This board features 1K RAM, 10 K of PROM space, a 2400 baud cassette interface, 20 I/O lines, real-time clock, DMA and even 8080-type I/O.

For graphics freaks

Although large computers have been handling graphics in various applications for some years, it is only recently that micros have been put to work in this field.

Now an Australian company, John F. Rose Computer Services, is putting together a variety of systems with different graphics capabilities.

Based on the Matrox video boards, their systems start with a simple 256 x 256 monochrome display and range up to a machine with eight Matrox boards and a special PAL colourizer, which can display up to 256 different colours.

Also available is a camera/digitizer input, as well as an interface and software to do colour plotting on an HP plotter.

As an example of their work, this illustration will feature heavily in their advertising soon, so you can see what they're doing

Rumours

Intel seem to be keen on adding powerful maths capabilities to their range of microprocessors and peripherals. While they are about to introduce their 8087, an arithmetic processor chip designed to work with the 16-bit 8086, they have also set up a second source deal with Advanced Micro Devices Inc to become second source for that company's Am9511 arithmetic processor and Am9512 floating-point processor. Both these devices are intended to work with 8-bit processors, the 9512 in particular offering a great speed advantage over software floating point packages.

Hewlett-Packard have introduced a microprocessor development system based on a large hard disk which will support up to six development stations simultaneously. Support is immediately available for the Intel 8080 and 8085, the Motorola 6800 and the Zilog Z-80, with other chips to follow. The basic system sells for around $25 000 in the US, and boasts a 20 Mbyte disk coupled with an HP 16-bit processor . . .

68000 is still coming! The masks for Motorola's 16-bit advanced microprocessor have been revised twice now, with samples of the second batch released to a very few prospective users outside the company. Formal introduction of the part should be mid-September.

The trade secrets case filed by Mostek against the UK Government-backed Inmos has been dismissed by a Federal judge in Dallas. Mostek brought the suit after several employees left to join the British company.

A new family of microprocessors is being developed at National Semiconductor, which will offer compatibility between the 8-, 16- and 32-bit members of the family. The NS16000 series will be made using National's high-density X-MOS process . . .

Printout

FCC waives RF modulator rule

A mid-September ruling by the Federal Communications Commission has enabled Texas Instruments to proceed with plans to market their home computer without a special monitor using an RF modulator instead to produce a display on a domestic TV set.

Originally, TI had applied for a waiver to enable them to obtain type approval for the modulator alone, rather than submitting the complete computer for approval. This would necessitate the submission of the complete computer every time a revision or update is made, with consequent expense and delay.

The FCC ruling, which gives manufacturers the freedom to obtain type-approval for a single modulator and then fit it to all their products, has not been greeted with any enthusiasm by the industry. Apple Industries, who originally opposed the TI waiver application, claim that it will give TI 'an unfair advantage' as other manufacturers have gone to a lot of trouble and expense to get their computers type approved or to use video monitors.

NS Users

Users of National Semiconductors' microprocessors (SC/MP, PACE, INS8080m and variants thereof) should be aware of NS Electronics' newsletter/magazine — "Compute".

Although COMPUTE is produced in the US, NS Electronics in Victoria are now producing local updates. Further information from NS Electronics, PO Box 89, Bayswater, Vic 3153.

Computer Club Directory

SECTION 1 — arranged by districts

Adelaide
South Australian Microprocessor Group Inc, PO Box 113, Plympton, SA 5038. (08) 278-7288. Meets at 7.30pm on the second Friday of each month at Thebarton High School, Ashley St., Thebarton.

Armidale
New England Computer Hobbyists Club, C/- Union, University of New England, Armidale, 2351.

Brisbane
IREE Microcomputer Interest Group, PO Box 81, Albion, QLD 4010. (07) 356-6176.

Canberra
Microprocessor Special Interest Group (MICSIG), PO Box 446, Canberra City ACT 2601. (062) 72-2237

Geelong
Geelong Computer Club, c/- Ian Stacey, (052) 22-1455 (business hours). Meets 2nd Thursday of each month at Tybar Engineering, Hampton St., Newtwon, Geelong VIC 3220.

Hobart
Tasmanian Amateur Computer Society, PO Box 474, Sandy Bay, Tas. 7005. Meets 7.30 pm on first and third Tuesdays of the month in the Computer Studies Area of the Rosny Matriculation College.

Melbourne
Microcomputer Club of Melbourne (MICOM), PO Box 60, Canterbury VIC 3126. Meets on third Saturday of every month at AMRA Hall, Willis St., Glen Iris, opposite Glen Iris Railway Station, at 2 pm.

Melbourne
Monash Personal Computing Club, c/- Union Building, Monash University, Clayton. Vic. 3168.

Newcastle
Newcastle Microcomputer Club, c/- Dr. Peter Moylan, Dept. of Electrical Engineering, University of Newcastle, Newcastle NSW 2308. (049) 68-5256 (office), (049) 52-3267 (home).

Orange
Bruce Carroll, (063) 62-8703 or Neville Wilde (063) 31-5809 or write c/- PO Box 1117, Orange 2800.

Perth
Western Australian Computer Enthusiasts Group, c/- R. Langlois, Memorex Pty Ltd, 49 Haty St., Subiaco WA 6008. Meets last Monday of each month at 7.30 pm at Taimac Video Corporation, 1st floor, Cnr Newcastle and William Streets, Perth.

Sydney
Microcomputer Enthusiasts' Group, PO Box 3, St. Leonards NSW 2065. Meets at WIA Hall, 14 Atchison St, St Leonards, on the first and third Mondays of the month at 8 pm.

Sydney
IREE Microprocessor Group, c/- Dr. Barry Madden, School of Chemical Technology, University of NSW, PO Box 1, Kensington NSW 2033. (02) 662-2423.

Sydney
Marrickville Microcomputer Society, c/- 26 Malakoff St., Marrickville NSW 2204. (02) 569-5689.

Wagga Wagga
c/- David Aleksic, PO Box 186, Wagga Wagga NSW 2650.

Wollongong
Wollongong Computer Club, c/- Gary Nelson, 220 Farmborough Road, Farmborough Heights, NSW 2526. (042) 71-4054.

NEW ZEALAND

Auckland
The NZ Microcomputer Club, PO Box 6210, Auckland 1, NZ.

Christchurch
c/- Paul Campbell, 50 Francis Ave, Christchurch, NZ.

Wellington
Wellington Microcomputer Club, PO Box 1581, Wellington, NZ.

SECTION 2 — arranged by processor or computer

Apple II
Apple II Users Club, c/- Computerland Australia Pty. Ltd., 55 Clarence St, Sydney 2000.

Exidy Sorcerer
Exidy Sorcerer Users Group, c/- Frank Schuffelen, 66 Porter St, Templestone Vic. 3106.

Exidy Sorcerer
Sorcerer User's Group, PO Box 43, Peakhurst NSW 2211. Meets at WIA Hall, 14 Atchison St, St Leonards, 4th Monday of every month. Workshops on 1st Friday of odd months, 2nd Friday of even months.

TI59
TI59 User Exchange Service, c/- Serge Petelin, 95 Gerler St, Bardon QLD 4065. (07) 450-2026.

TMS9900
Australian 9900 Users Group, PO Box 835, Melbourne Vic. 3001. Barry Day, (03) 661-2523 (business hours).

TRS-80
TRS-80 Users Group, c/- G.F. Stevenson, 34-36 Sturt St, Adelaide, S.A. 5000. (08) 51-5241. Meetings 1st Thursday of every month at address available from the above.

TRS-80
TRS-80 Users Group, c/- Les Kinch VK2BBD 128A Booralie Rd, Duffys Forest NSW 2084. (02) 450-2026.

2650
Australian 2650 Users Group, c/- Applied Technology, 1A Paterson Ave, Waitara, NSW 2077.

8080/8085/Z-80
AT-80, c/- Rod Whitworth, Planet Three Systems, 47 Birch St, Bankstown NSW 2200.

JBUG bug debugged

DAVID CRAIG, of Holland Park QLD, has written to tell us of a bug in the JBUG monitor of the Motorola D2 evaluation kit. The bug concerns the operation of the G key, which has two functions: in the memory examine mode, it allows successive memory locations to be examined, and altered, if need be; while if the monitor is not in the memory examine mode, the G key starts execution of the user's program.

The problem is that the memory examine mode is set, in the monitor, by a flag (MFLAG) which is set to one when the M key is depressed. Unfortunately, successive depressions of the G key also increment the contents of MFLAG, so that after 256 bytes have been examined, MFLAG has reset to zero. JBUG is no longer in the memory examine mode (even though the user thinks it is) and so the next depression of the G key will start execution at some location in memory, sometimes with catastrophic results!

David offers a solution, in the form of a short routine which can be inserted in the stack RAM:

A040 8E A0 78 LDS $A078
Restore stack pointer.

A043 7E E2 5B JMP KEYD1F
Display next memory location.

A07E A0 40 FDB
Establish user program counter on the stack.

This causes the GO TO operation on the 256th G key depression to jump to the KEYD1F routine in JBUG which displays the next memory location. Inserting this patch will save D2 owners from the horrendous experience of entering a long program through the keyboard as machine code, and then seeing the system crash after all that effort!

On behalf of D2 owners everywhere, our thanks go to David. ●

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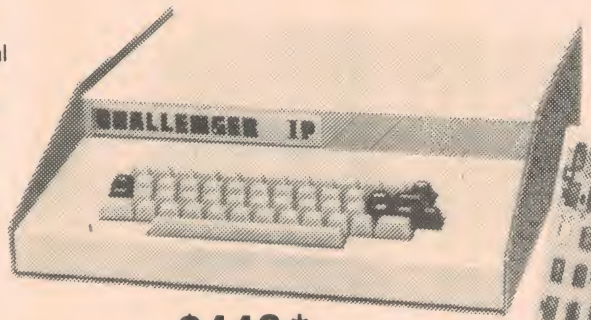

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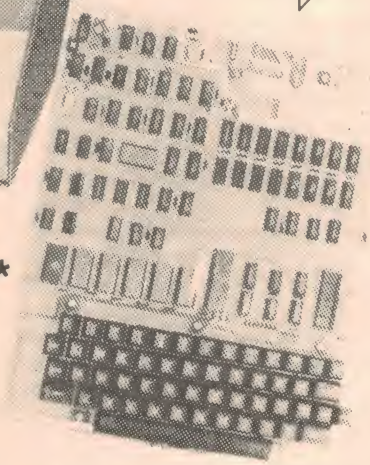

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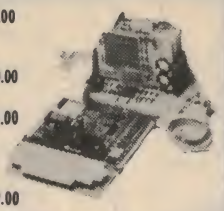

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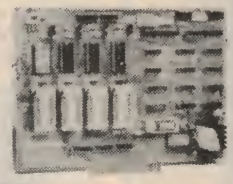

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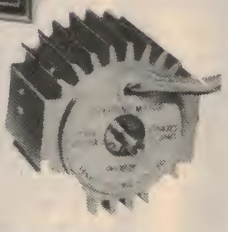

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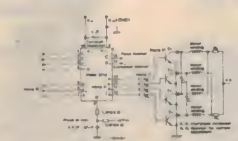

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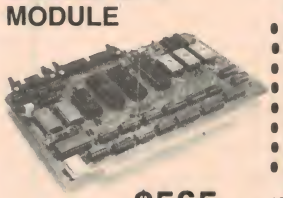

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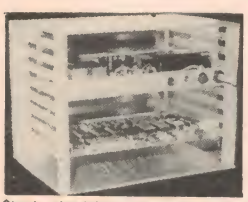

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Review of the HP-41C personal calculating system

by Les Bell

A 'personal calculating system' with the power of a personal computer for an amazing price

IN WRITING THIS ARTICLE, I am acutely aware that my personal enthusiasm is going to show right through it to the point where the reader may well suspect me of bias! The only answer I have to this is that, once you have read the article, or better still — seen the machine, you will be just as biased as I am.

When Hewlett-Packard released the HP-67 and 97 programmable calculators I decided that they had reached the ultimate in pocket calculator power. Surely, I reasoned, no-one could use more portable computing power — for anything more complex than these calculators could handle, a personal computer, though less portable, would be a better solution.

Well, I was wrong.

With the release of the HP-41C, Hewlett-Packard have introduced a pocket calculator which is more powerful than many personal computers. The key to the power of the machine is its ability to manipulate and display alphanumeric characters. This means that it can display and understand letters and punctuation marks as well as numbers.

In appearance, the HP-41C is similar to most current pocket calculators. The keyboard looks rather like previous HP calculators with a few curious additions — the letters of the alphabet from A to Z plus =, ?, :, space and , (comma) are printed on the front of most keys, and there are some new functions like XEQ and ASN. The display is a liquid crystal 16-segment type with 12 character positions, which also displays the current trigonometric mode and other status indicators.

Alpha operation

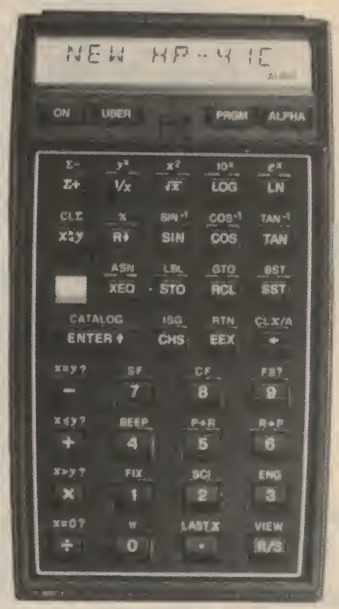
The use of alphanumerics means that the keyboard of the HP-41C is remarkably uncluttered for such a powerful machine. For example, take the method for calculating the standard deviation of a group of data. As on previous HP machines, the data is accumulated using the Σ+ key, but there is no 's' key to return the standard deviation. Instead the XEQ key is depressed, followed by the ALPHA key, then the letters S, D, E, V are entered into the display. Finally, the ALPHA key is depressed once more to return the machine to its normal mode; this acts like a carriage return on a computer, and the calculator accepts the command, returning the result of the standard deviation calculation in the display.

One hundred and thirty functions are crammed into the machine in this way, without making the keyboard so complex as to be unusable. In case you forget the functions that are available, the CATALOG command will sequentially list all the function names in the display to remind you. In fact, the machine maintains three catalogues, one of the programs the user has entered into the machine, one of the programs contained in Application Module ROMs and peripherals plugged into the machine, and one of the built-in functions of the machine itself.

The alpha capabilities of the machine are not the only new thing about it. At the top of the case there are four multi-pin sockets which are in fact I/O ports. Into these you can plug various optional extras, including extra RAM, ROM in the form of Application Module software, a magnetic card reader, a printer (with plotting capabilities), and a soon-to-be-released bar code reader.

System expansion

RAM first. The basic calculator has 441 bytes of storage in CMOS RAM which can be allocated to program steps or storage registers as necessary. Each storage register takes up seven bytes, while program steps may take one,two, or three bytes. Alphanumeric characters occupy one byte each. This means that the calculator can be set up with 63 data registers or approximately 200 to 400 lines of program memory, or any combination in between.



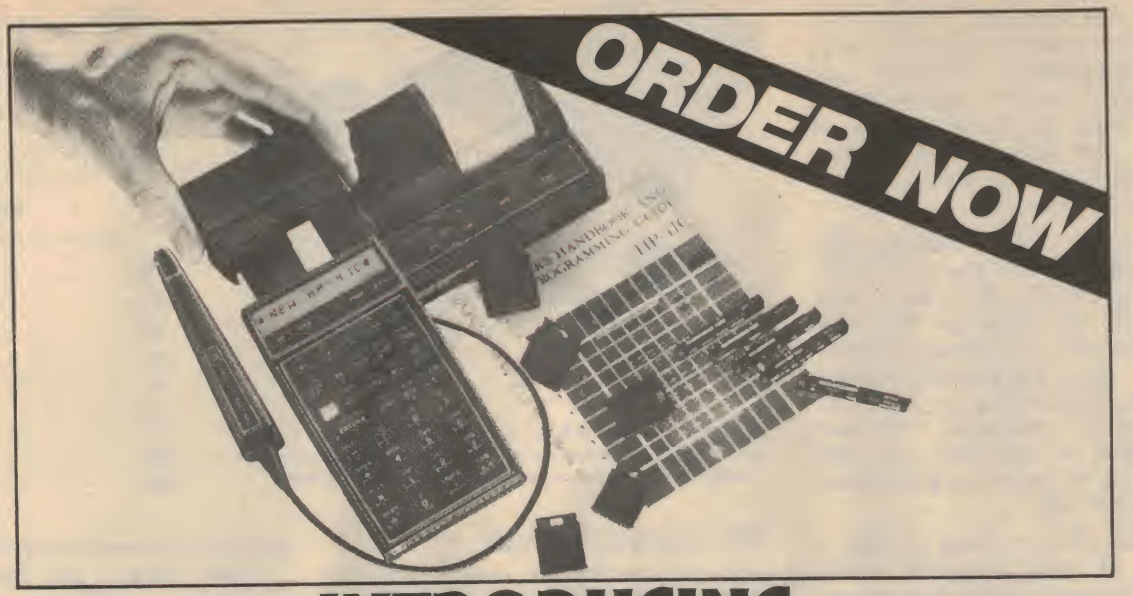
It looks deceptively like a calculator, but much, much more hides beneath that wily keyboard.

If that isn't enough, extra memory can be added, in 448 byte blocks, to a maximum of four memory modules. This will give up to 319 memory registers or 1000 to 2000 lines of program storage. If that's not enough, you need a computer not a calculator! The RAM in the memory modules is also CMOS and will retain its contents as long as it is plugged into the calculator.

The plug-in ROM Application Modules contain up to 8 Kbytes of software — that is, somewhere between 4000 and 8000 lines of program maximum! A wide range of Application Pacs will be made available, similar to those for the HP-67 calculator. These will include Circuit Analysis, Mathematics, Aviation, Statistics, Stress Analysis, Games Navigation and several other titles.

Peripheral power

In peripherals, the HP-41C sets a whole new standard. The most important for many users is the printer, which offers a wide range of facilities. Like that on the HP-97, it can print results of numeric calculations, as well as intermediate results. However, it can also print letters and punctuation, both upper and lower case, from a special ▶



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THE CALCULATOR.

It features over 130 functions and offers up to 400 lines of program memory or 63 data storage registers—expandable to 319 registers or up to 2,000 lines. And for power, ease-of-use and efficiency—RPN Logic.

It communicates. The HP-41C's alphanumeric capability lets you name and label programs, functions, variables, constants—and prompt for data with words or sentences.

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Continuous memory. Even when turned off, the HP-41C retains all your program, data and key assignments.

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register in the calculator. If that's not sophisticated enough, it can also print user-created graphics characters, and automatically perform high-resolution plotting, with automatic scaling of units! All the power of the printer comes from its built-in microprocessor and driving software.

The printer ROM contains 24 programs with names like BLDSPEC, PRBUF, and PRSTK. These can be run from the HP-41C using the XEQ and ALPHA keys, but if the programs don't perform in quite the manner required for your application they can be downloaded into the calculator RAM and then modified to suit. Thus, the plot programs can be altered to print histograms, for example.

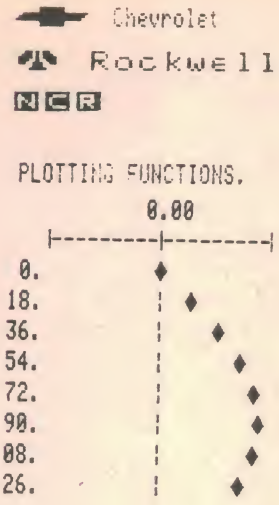
For those who are likely to have a collection of long programs which cannot all fit into the calculator at one time, or for current HP-67 or 97 owners, the magnetic card reader is a useful accessory. Occupying one I/O port, the card reader slips neatly onto the top of the calculator, and is, like the printer, an intelligent peripheral. Part of the philosophy of the HP-41C is that the user should only have to pay for those facilities which he requires, and so the basic calculator does not contain any of the peripherals' intelligence.

The HP-41C card reader is intelligent, and will prompt the user for the next card side to be inserted in a multi-card sequence; for example 'READY FOR 3 OF 7'. It doesn't matter in which order the cards are inserted, the card reader will recognise and store them in the correct area of memory.

For insertion of program lines when editing, the HP-41C unpacks lines of program code, leaving gaps between them. When a program is loaded, there will be a pause while the calculator re-packs the program memory in the densest possible configuration, and the display will show the prompt 'PACKING' to let the user know what is going on.

To maintain compatability with the earlier HP-67 and 97, the card reader is able to read HP-67 program cards and translate HP-67 keycodes like f P≷S, which don't make sense to the HP-41C, into calls to subroutines stored in the card reader which execute the desired function.

The card reader also offers some new functions, such as the ability to record a card which cannot subsequently be listed or modified by the user, only run. Previously write-protected cards can also be overwritten. Again, all the intelligence to perform these functions has been built into the card reader — effectively making the calculator into a mini distributed-intelligence system.



ABOVE: The HP-41C with printer and assorted peripherals. RIGHT: At top are examples of the special character capabilities, while beneath is portion of a sine plot.

The calculator itself

Even disregarding the power of its peripherals, the HP-41C is an immensely sophisticated calculator. The use of an alphanumeric display enables the calculator to 'prompt' the user; for example, when the STO key is pressed, the word 'STO' appears in the display, followed by two dashes to indicate that a two digit register number is required. Once the two digits are supplied, the display returns to the previous value in the X register.

Two new instructions replace the old DSZ (decrement and skip on zero) and ISZ (increment . .) instructions. The ISG (increment and skip if greater) and DSE (decrement and skip if equal) instructions permit the user to increment a register by a selectable increment (not just one), and test against a selectable value (not just zero). This gives a capability similar to the FOR . . NEXT loop in BASIC.

Labelling in programs is rather more sophisticated than in previous calculators. Labels A to J, a to e and 00 to 99 are local labels, while all the rest are global. This means that a GTO D instruction in the currently executing program will not jump to a LBL D in another program, causing a crash. However a GTO M will search right through program memory, not just the running program, allowing one to call subroutines in other programs, or exit from the running program.

The way the HP-41C searches for labels in memory is interesting. While previous HP calculators would search onwards through program memory following a GTO label instruction, the HP-41C operates somewhat differently. Branches to labels 00 through 14 are handled as relative branches within plus or minus 112 bytes of the GTO instructions. Labels 15 through 99 occupy twice as much space in program memory (two bytes), but the calculator remembers the location of these labels regardless of their location in a program.

Alpha labels are handled in a completely different way. The calculator maintains the Alpha labels as a linked list; each alpha label also contains the address of the next alpha label. The calculator then can search extremely quickly for labels.

Design a calculator

A unique facility of the HP-41C is the USER mode, in which built-in functions, routines or even programs can be accessed through a single key stroke. In fact, any key on the calculator can be given a different meaning from that in the normal mode, by using the ASN (assign) function. Thus, a statistician who calculates a lot of standard deviations would find that keying in XEQ, ALPHA, S, D, E, V, ALPHA is a bit tedious, but he could reassign the SIN and COS keys, which he might never use, to stand for mean and standard deviation.

There are 56 flags in the HP-41C, some of which have predefined functions, such as indicating whether a printer is attached to the calculator. Special instructions enable a flag to be automatically cleared after test, and five of the flags are continuously indicated in the display, so you can see their state. For the ones which aren't displayed, the calculator lets you test a flag, returning a display of YES or NO.

Odd functions

Built into the calculator is an audio beeper, which has ten programmable tones. These are primarily intended for audio alarm of error conditions, but I dare say they could be programmed to play a tune!

Complete control of the display format is possible. The calculator can be set to display numbers with commas between the thousands and a decimal point before the decimal fraction. Or,

by setting a flag, it can display numbers with points between the thousands and a comma before the decimal fraction, in the European style. The calculator is set to the correct mode by the shipping department before being delivered to the customer – that's the kind of attention to detail that keeps HP customers coming back for more!

The display does not always display the contents of the X register, but can be set in VIEW mode and then used to examine the contents of the stack, the alpha register, or any memory register, without disturbing the contents of the stack.

An OFF instruction lets a running program turn the calculator off to conserve the batteries (alkaline cells give up to a year's option), while an ON instruction disables the automatic power-down facility which would otherwise switch the calculator off if it is not used for ten minutes or so.

All the usual functions of a programmable calculator are there, of course, including the relational tests, factorial, logs, trig, percentages, rectangular/Polar conversions, and so on. Interestingly, particularly in view of the alpha capability of the calculator, HP have brought back the octal/decimal functions of the HP-65, rather than hex, which would be more popular, as well as a showpiece for the alpha-numeric display.

Also, in the interest of improved accuracy, there are two new log functions – exp(X-1), and 1n(X+1), which would probably never be used from the keyboard, but can improve the accuracy of programs considerably.

Whatever next?

If after considering all this, you are feeling somewhat shell-shocked, as I am, you might like to consider what might be in the offing as accessories for the HP-41C.

For a start, HP have annouced there will be a light wand bar code reader for the HP-41C. This means that they will be able to publish software in the form of bar code, and from the beginning of 1980, their User Solution Books will include bar code to save the user keying in long programs.

However, it is interesting to conjecture what else might be under development, as yet unannounced, to match the HP-41C. Since the machine is byte oriented, it is possible (even probable?) that HP might introduce a parallel interface for the calculator to allow data acquisition. This would make the machine suitable for applications now being met by the HP-97S, a modified HP-97 with BCD input and bit output. Perhaps to match this there might be a clock or timer module.

In the September issue, we reviewed the Calcumeter, a digital multimeter with built-in calculator and some 'smart' functions. Obviously, the HP-41C is intelligent enough to do all that the Calcumeter does, and the distributed intelligence concept behind the calculator would make it possible to add a multimeter module containing all the required circuitry plus software to perform scaling, averaging, and other functions. I'm sure HP must be thinking of this; the potential is just too good to miss!

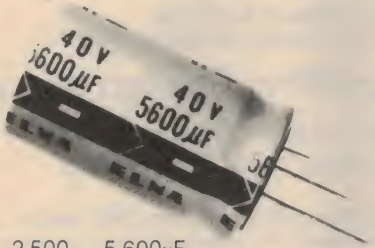
How much?

Although by now you are probably prepared for a price around several thousand dollars, you can breathe easy. The prices for the HP-41C and its peripherals are a lot lower than you might expect. The calculator itself retails for $315 plus tax, while the card reader, printer and memory modules sell for $209, $375 and $48 respectively. That's not bad for a personal computer system, supplied fully assembled and tested, with some very sophisticated software.

Already, we've noticed an increase in the number of second-hand HP-67's for sale! ●

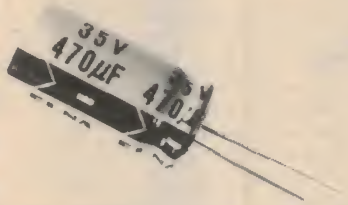
SOANAR CAPACITORS

RP PCB Can Electrolytic



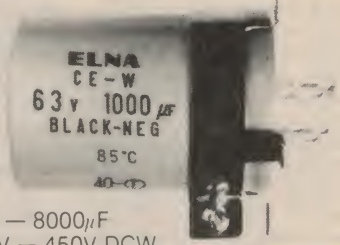
2,500 — 5,600µF
35V — 80V DCW

RB Radial Electrolytic



.47 — 2,500µF
6.3V — 450V DCW

RG/RD Lug Terminal

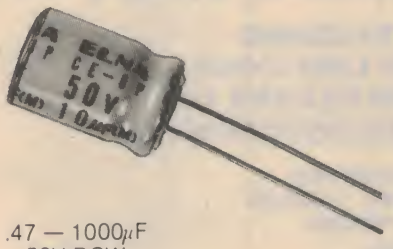


90 — 8000µF
15V — 450V DCW
SINGLE, DOUBLE, TRIPLE

DT Polypropylene Film

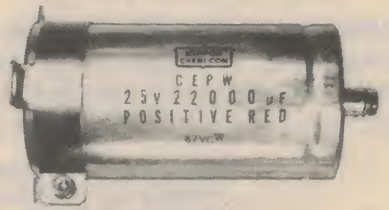
.01 — .47 µF
200V — 630V DCW

RBP Bi-Polar Electrolytic



.47 — 1000µF
50V DCW

Computer Grade Electrolytic



2900 — 68000µF
16V — 40V DCW

TL/TH Ceramic Disc.

1.0PF — .47µF
63V + 630V DCW

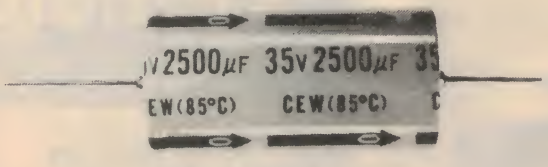
TAD Tantalum Electrolytic

.1 — 100µF
3.15V — 35V DCW

NL/NH Polyester Film

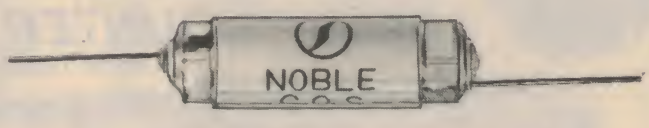
.001 — 10µF
100V — 630V DCW

RT Axial Electrolytic



.47 — 4,700 µF
6.3V — 500V DCW

PS Polystyrene Film



10PF — .01µF
125V DCW

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DXing China now in vogue

Even the most casual of shortwave listeners would have, at some time, tuned in a broadcast from Radio Peking — they're hard to miss as the station has many high-powered transmitters and beams an English programme to Australia between 0830 and 1030 on 11 725, 11 600, 9460 and others.

Many listeners would also have sent reception reports to the station and received a Radio Peking verification card in reply (along with much other literature!).

This very co-operative attitude has not extended into the area of Home Service programmes. The domestic services from both Peking and radio broadcasts from the many regional shortwave centres, have been something of a mystery to DXers. The two major factors contributing to this mystery have been the difficulty of language, and the fact that neither Peking nor any regional broadcaster in China would answer reception reports from DXers.

This has changed dramatically in recent months.

There is now great interest in the broadcasting scene in China. This is because Radio Peking in recent months has been issuing verification cards (QSLs) for reception reports of their programmes as relayed by regional centres.

DXers are now able to obtain full detail QSL cards from Peking for reception of the broadcasting stations in such exotic locations as Tibet, Inner Mongolia and Manchuria.

Most of China's provinces and autonomous regions have their own shortwave broadcasting stations. These regional stations broadcast local programmes as well as frequent relays of programmes from Peking.

The main domestic service programme is broadcast from Peking, mostly in standard Chinese, and in two varieties, known as programme one and programme two. This main Peking service is known as the Central People's Broadcasting Station.

The first programme is on air daily 2000 until 1735, and uses many frequencies. Some of the best received in Australia are 3220, 4905 and 7095 during our evening hours. The second programme from Peking is on air 2100-1700 daily, and may be heard on such outlets as 5075, 7770 and 8320 during our evenings and early mornings.

All Peking programmes begin with the song "The East is Red" and conclude with "The Internationale". Although most programmes are in Chinese, you may occasionally hear some English segments and there are often English language lessons in domestic programmes.

Some of the regional broadcasting stations scattered throughout China are very well received in Australia. Following is a list of some of the stations and their frequencies which are best heard currently:

Huhehot, in the Inner Mongolia autonomous region, on 6840.

Lhasa, in Tibet autonomous region, on 5935, 4750, 4035.

Urumchi, in the Sinkiang-Uighur autonomous region, on 4970.

Nanning, in the Kwangsi autonomous region, gives good reception on 4915.

Harbin, in the area formerly known as Manchuria, currently heard on 4840.

All the above stations provide good reception in our evenings from about 1200 onwards. Sign-off time varies, depending on the station location. Harbin, in north eastern China closes down at about 1430, while Urumchi, in far western China, closes transmission at about 1600 most evenings.

None of these regional stations currently issue QSLs for reception reports. The only way you may obtain a verification card for a regional station is to report reception of the local station when it is relaying programmes from Peking. Your report should then be sent direct to Radio Peking. Your report should be accompanied by a polite request that the site of the transmitter reported be included on the verification card. You should clearly state the location of the transmitter you are reporting.

But how will you know when a regional station is taking a relay from Peking?

There are two methods of discovering when relays are taking place. Probably the best way is to report a station when it is relaying Peking's special programme in the language of that region.

The times of these special minority language programs are very regular. Urumchi on 4970, for example, carries Peking's programme in the Kazakh language every day between 1400 and 1455. Likewise, Lhasa carries Peking's Tibetan language programme daily from 1100 to 1155 on 4035 and 9490. The second way to identify when a Peking relay is taking place takes more time. Should you hear Urumchi on 4970, Harbin on 4840 and Lhasa on 5935 all carrying the same programme, then it is a fair bet they are all taking programmes from Peking. This often occurs on a Saturday evening for performances of Peking operas.

With Peking now verifying reports of regional stations DXers now have a whole new field to explore. China, with dozens of shortwave broadcasting sites scattered across the country, offers both a great challenge to DXers to monitor and identify the stations they hear, as well as great rewards in the form of QSLs which even a year ago would have been regarded as impossible to obtain.

DXing China has become all the rage in the USA and Europe, and Australian DXers look like following this trend.

New Mongolian transmitter.

Radio Ulan Bator is apparently using a new high power transmitter for relays of the domestic service programme, heard on 11 855 from 1000 to 1500 daily.

Programmes are in Mongolian, with a relay of Radio Moscow's Mongolian service from 1200 until 1245. Although this outlet is an old-established Ulan Bator frequency, the excellence of current reception in Australia indicates a new transmitter has recently been brought into use.

A parallel outlet for Radio Ulan Bator is 4995, also heard to sign-off at 1500 nightly.

Meanwhile, you may currently hear English from Mongolia every day from 1220 until 1250 on 9575 and 12 070. The latter outlet gives best reception into east Australia at present.

Compiled by Peter Bunn, on behalf of the Australian Radio DX Club (ARDXC). Further information on DXing or the activities of ARDXC may be obtained from either PO Box 67, Highett, VIC 3190, or from PO Box 79 Narrabeen, NSW 2101, for a 30c stamp.

NOTE! All times are given in Greenwich Mean Time (GMT). To convert GMT to Australian Eastern Standard Time, add 10 hours. To convert to Central Time, add 9 hours, and for Western Time, add 8 hours. All frequencies are in kHz.

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loggings

Asian stations will be received earlier in the coming months so look for them around 0900 on the 49 m band.

Costa Rica moves

Radio Noticias del Continente at San Jose, has moved to the new outlet of 9490 for the programme between 0530 and 1130.

The move has been made to avoid harmful interference from the missionary station KGEI in San Francisco which also uses 9615 during our evenings, like Radio Noticias broadcasts in Spanish.

Radio Noticias also broadcasts on 9490 from 2300 until 0500, and the 0530-1130 is a repeat of the earlier program.

New station for Papua New Guinea

A new shortwave station has begun broadcasts from Vanimo in West Sepik, on 3205.

Vanimo, on the north New Guinea coast near the Irian Jaya border, has been observed with test transmissions during the evening from about 0800. Transmitter power is believed to be two kilowatts, and the station is identifying as Radio West Sepik.

The National Broadcasting Commission is anxious to receive reception reports for the test transmissions, and these may be sent to: Box 181, Boroko, Papua New Guinea.

New outlet for Colombian commercial

The commercial station at Ibague, identifying as Ecos del Combeima, has moved to the new outlet of 6025, replacing 4785.

The station operates on a 24-hour schedule, but best signals in east Australia are noted between 0800 and 1000. From 1000, Radio Malaysia at Kuala Lumpur dominates this frequency.

Watch for Asian reception

The upcoming summer months will mean earlier signals from the Asian continent during our local evenings due to the onset of the northern winter and earlier sunset in northern latitudes.

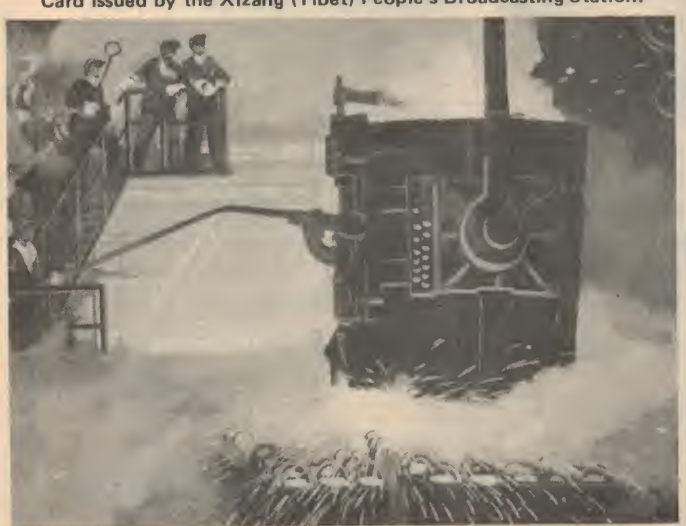
South East Asian signals should be well heard on the 49 metre band by 0900, and some stations to watch for are:

Far East Network, Tokyo, in English, on 6155.
Nihon Shortwave Broadcasters, Tokyo, in Japanese and English, on 6055.
Radio Republik Indonesia, at Menado, Sulawesi, in Indonesian, on 5987.
Radio Malaysia Sarawak at Sibu, on 6050, in Malay and local languages.
Radio Republik Indonesia at Jayapura, Irian Jaya, in Indonesian on 6070.

Signals from Central and South Asia may be heard well on 49 metres by 1200, and ones to watch for include:

All India Radio at Delhi, in Hindi and English, on 6120.
Azad Kashmir Radio at Muzzafarabad, in Kashmirri and Urdu, on 6020.
All India Radio at Madras, in Hindi and English, 6085.
The Indian stations have news in English at 1230, relayed from Delhi.

Card issued by the Xizang (Tibet) People's Broadcasting Station.



"World at your fingertips international"

Radio Monitors International, heard over the Sri Lanka Broadcasting Corporation every Sunday evening, will carry the Australian Radio DX club programme "World at Your Fingertips International" (WAYFI) on November 18.

WAYFI presents DX tips and news of particular interest to Australian shortwave enthusiasts.

As a bonus the ARDXC now issues full colour QSL cards in response to correct reception reports of the WAYFI programme. Send your reception reports to the address in this column, and please include return postage.

World at Your Fingertips International is a 15 minute segment heard monthly on Radio Monitors International. Listen for Radio Monitors International each Sunday night at 1100-1130 on 11 835, 15 120 and 17 850. The programme is repeated at 1400-1430 on 9720, 6075 and 15 425.

Upcoming features in the programme include "Radio broadcasting on Gibraltar" on November 11, and November 25 will feature "Radio broadcasting in Puerto Rico".

The last great wild SYNERGISTIC* beer-drinking bash!

Friday 7 December – commencing about 6 pm at the Bilgewater . . . er, Bayswater Hotel which is still located in Bayswater Road, Rushcutters Bay, just up from the Rushcutter Bowl (at the traffic lights).

Now's your chance – no more excuses, this is the last opportunity you'll get for dropping brickbats and throwing bouquets. We might discuss electronics, or the magazine, or . . . . anything !

*** Synergism, synergy, ns. Combined effect of drugs, organs etc that exceeds the sum of their individual effects.**
Synergistic, adj. From Greek - synergos - working together.

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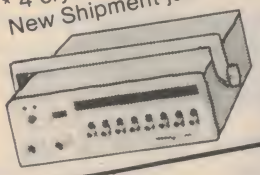

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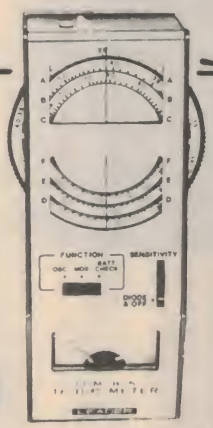

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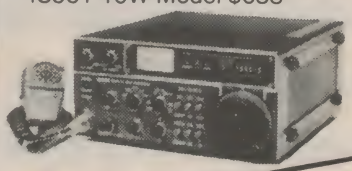
IC551 10W Model $683



LSG 16 RF SIGNAL GENERATOR

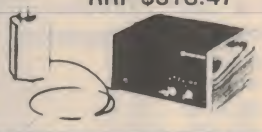
100KHz-100MHz Solidstate RF signal generator. Suited for aligning the IF circuits in AM, FM and TV sets.

$119

DA 100

Wide band active receiver antenna.
Features:
1. Masthead pre-amp
2. FET antenna tuner
3. 50KHz — 3MHz

RRP $318.47

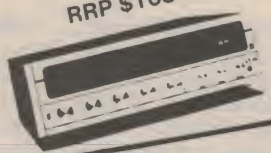


DR22

The DR22 is a high performance general coverage receiver.

Features:
1. Digital synthesizer
2. Bright LED display
3. Multi mode reception

RRP $1687



27MHz Marine Transceivers

AC516 ANA incl. one channel — $126.00
MARINE ANTENNAS ALSO AVAILABLE!

Coax Relays

CX-2L 1.8-170 MHz, 100 w pep — $45.00
CX-2H 1.8-450 MHz, 200 w pep — $69.00

SWR/PWR Meters

VC2 Popular twin meters, 3-150 MHz — $35.00
SWR200 Oskerblock, 3-200 MHz — $86.00
CN620 Daiwa, cross-needle type, 1.8-150 MHz — $99.00
CN630 Daiwa, 140-450 MHz, direct read — $135.00

Cameras

EX-803 B&W, handheld with 4:1 300m — $414.00

Plugs & Sockets

BNC Plugs $2.80
BNC Jumper leads $6.20
BNC Chassis Sockets $2.80
BNC "T" adaptor $5.60

2m Bi-Linears

MR900E Tono, 80-90w incl. Rx preamp — $289.00
MR1300E Tono, 120-B&W incl. Rx preamp — $350.00

Kenwood Transceivers

TS520S HF transceiver — $635
TS120S Solid state 100w — $735.00
TS120V Solid state 10W — $600.00
TS180S Solid state 10w — $1240.00
Call us today for a good deal.

Microphones

VM-1 Noise cancelling, hand ptt, low z — $10.00

Coaxial Cable

RG58AU mil spec. 30m reels — $13.00
RG213/U mil spec. per metre — $1.40

ICOM Gear

IC701 transceiver NOW — $1199.00
IC22S 2m transceiver — $299.00
IC551 6m transceiver — $799.00
IC280 2m fm remotable — $450.00
IC502 6m ssb portable — $239.00
IC202S 2m, ssb portable — $318.00
IC211 2m all mode — $847.00

Morse Keys

HK702 Deluxe Key with marble base — $41.00
HK708 Economy Key — $23.00
HK706 Operator's Key — $25.00
MK701 Manipulator (side-swiper) — $45.00
PALOMAR 1C Keyer — $149.00

Baluns

AS-BL Asahi 50 ohm for beams — $34.00
BL50A 50 ohm, 4 KW, 1:1 for dipoles — $32.00

Radio Teletype Terminal

0-7000 Tono RTTY CW/Baudot/ASCII — $839

VICOM

Duncan Baxter VK3LZ
Customer Service Manager

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Rockhampton 28 2843
Perth 321 3047
Newcastle 69 1222
Gold Coast 32 2644
Geelong 78 9660
Melbourne 836 8635
Brisbane 341 2332
Townsville 72 2633

Vicom
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South Melbourne,
Victoria, 3205.
(03) 699 6700

Launceston 44 3882
Brisbane 38 4480
Adelaide 272 8417
Kalgoorlie 21 1906
Wellington(NZ)287 946
Wagga 21 2125

COMMUNICATIONS

Kenwood enters general-coverage receiver market

The recently-released Kenwood R-1000 receiver is a general-coverage unit employing a Wadley-loop front end covering the range 200 kHz to 30 MHz in 1 MHz wide bands.

The unit will resolve AM, SSB and CW transmissions and features three selectivity bandwidths: 9 kHz (AM-wide), 5 kHz (AM-narrow), and 2.7 kHz for SSB and CW.

Sensitivity is quoted as 1.5 uV for SSB/CW over 200 kHz to 2 MHz, 10 uV for AM; 0.5 uV for SSB/CW over 3 — 30 MHz, 3 uV AM. Frequency stability is given as plus or minus 2 kHz maximum from one to 60 minutes after switch on, then within plus/minus 300 Hz during any 30 minutes thereafter.

The R-1000 features a digital clock with timer, tone control, recording outlet and a stepped attenuator (0, 20, 40, 60 dB). The latter is very useful in reducing the effects of front end overload from strong local signals.

Recommended retail price is $498 (inc. S.T.) and the units should be available this month. More details from Trio-Kenwood (Australia) Pty Ltd, 30 Whiting St, Artarmon 2064 NSW; (02) 438-1277.

Symposium success

The 1979 F.A.C.T. Symposium, held over 29/30 September-1 October at Noah's Northside Gardens in North Sydney, was another successful event, according to those who attended, and enthusiastic plans have been laid for the 1980 Symposium.

Although attendance was down on last year, the enthusiastic audience stirred up some very fruitful discussion sessions.

Project ASERT — an amateur investigation into propagation phenomena — which grew out of discussions at last year's Symposium, seems set to expand its programmes and activities over the next twelve months as a result of some very animated discussion following Ken McCracken's (VK2CAX) paper on 30 September.

Full report next month.

Solar/ionospheric reports by phone

The Ionospheric Prediction Service opened a telephone service on October 1 giving recorded information on solar and geophysical parameters for the past 24 hours and predictions for the following few days.

If you ring (02) 269-8614 you will hear a recorded message, as at 0010 UT each day, giving details of any current geomagnetic/ionospheric warnings, solar events and geomagnetic disturbances along with the current 10.7 cm flux value and predictions for the following few days, the current A-index with the day's estimated value and predictions for the following few days and a report on the current ionospheric critical frequencies over Sydney (normal, depressed or enhanced).

The recording has that air of immediacy, what with the carefully-read text and the telex machine audible in the background!

We hope to have an article on how to use this information in ETI in the near future.

The Ionospheric Prediction Service is a branch of the Department of Science and the Environment and provides ETI with the computer printout propagation predictions we publish every month.

Speech processor

The most popular, and least expensive, method if increasing a transceiver's "talk power" is to add a speech processor.

The Daiwa Corporation's RF660 speech processor was recently released in Australia by Vicom. Offering a claimed 6 dB improvement in talk power the unit attaches to a rig via 'Velcro' fasteners and simply inserts in the microphone line. It operates from a nominal 13.8 Vdc supply.

Priced at $109, the unit is available through Vicom and their agents. For more information, contact Vicom at 68 Eastern Rd, South Melbourne Vic 3205. Phone (03) 699-6700.

Short hops

The Hawaii-California path has finally been spanned on 432 MHz. KH6HME is reported to have worked WB6NMT via tropo ducting, a distance of about 4000 km. This record may well be broken if a TEP path is bridged on 432 MHz during one of the coming equinoctial periods.

The Geneva WARC has turned into a bit of a 'knock-down-drag-out' session — it seems the delegates wasted more than a week bickering over who was to be chairman. Algeria, vociferous about HF and microwave planning during the run-up sessions, is taking a 'hard line' and exercising a strong voice — lining up many of the "Third World" nations behind it.

The 20-year-old Australian six metre DX record has been broken! VK3OT has had confirmation from XE1GE, following their contact on April 3 last. The record was previously held by VK3ALZ and XE1FU. The new record stands at 13 769 km. It seems that VK5KK may have worked the Mexican station but no claim has yet been made, we understand.

The peak of sunspot cycle 21 — the current one — may have already passed. Then again, it might peak early (Feb-March) next year. The scientists say we won't know until it's past.

The USSR has opened up the 160 metre band to their amateurs, including novices. Stations are permitted to operate on CW exclusively between 1850 and 1875 kHz, sharing with SSB operation between 1875 and 1950 kHz. AM operation is permitted only between 1900 and 1950 kHz. Apparently, novices may only work novices — presumably within the USSR. Novice callsigns are prefixed by EZ.

Amateur licencees in Australia increased 25 percent during 1978, from 8483 to 10 587. About half hold full calls, a bit less than one third hold limited licences and close on one fifth hold novice calls — which means quite a few hold dual licences and there is a distinct move to upgrade amongst novice-only licensees.

The two Russian amateur satellites, RS1 and RS2 (RS stands for "Radio Sport" as amateur radio is a sport in the USSR), are now inactive. Launched in October 1978, their relatively short life has been put down to radiation damage from 'excessive' radiation during the launch period.

Antenna market boom

The introduction of FM, the replacement of existing TV antennas and the growth of new TV Stations in SE Asia has resulted in boom conditions, according to Antenna Engineering Australia Pty Ltd, of Kilsyth Victoria.

AEA say they have just completed manufacture and commissioning of a new antenna system for MVQ6 in Mackay and the manufacture and supply of a combiner for Adelaide FM Stations 5MMM-FM and 5EB1-FM. Current orders include a new antenna system for BTV6 Ballarat, Channel 2 Hobart and a UHF transmitter combiner for the four Adelaide TV stations. Fifteen FM panel antennas for Telecom are also on the order book.

Australia's first circularly polarised FM antenna, at WA Universityy, was designed by AEA and installed in 1977.

TVT6 in Hobart currently operates an AEA antenna system, as do ten television stations in Indonesia. All were installed within the past three years.

According to AEA their current orders include many HF antennas and antennas and multicouplers for UHF and VHF two-way radio systems. A complete new antenna system for the Naval Station at Garden Island in WA is to be supplied and installed by AEA.

Vicom gains experimental licence

Vicom International gained approval to run a VHF/UHF colour television translator and an FM transmitter at the EEEMC Exhibition held at the Sydney Showgrounds over 16-19 October.

The translator was a Hirschmann 10 W unit which meets the Australian Broadcasting standards and CCIR specifications.

Hirschmann is an Austrian-based company specialising in VHF/UHF and VHF/UHF television translators from 1 W to 2 kW.

The FM transmitter used equipment supplied by CCA Corporation of USA and operated on 88.90 MHz.

High accuracy and auto triggering in low cost counters

Use of CMOS LSI circuitry and a one-chip microprocessor has cut the cost of two new frequency counters from Philips Test and Measuring Instruments.

The 120 MHz PM 6667 and 1 GHz PM 6668 provide high resolution, 15 mV sensitivity and auto triggering on all waveforms.

A choice of two measuring times is provided — either normal, with seven-digit resolution every second, or fast mode with six-digit resolution every 200 ms. Display is on a clear high contrast liquid crystal display.

High resolution is obtained by making multiple period measurements and computing the reciprocal value. The microprocessor eleiminates the traditional plus/minus one cycle error and avoids the need for long gate times or period measurements or the limitations of phase locked frequency multipliers.

High stability is provided by a standard crystal oscillator — ageing is quoted as less than 0.5 parts per million per month. For higher stabilities a temperature-compensated crystal oscillator is available with ageing less than 0.7 parts per million per month. An external 10 MHz reference can also be used.

The auto-trigger facility sets the trigger level automatically to the input waveform with no knob twiddling — even for low duty cycle pulses. In addition, the 1 GHz model has automatic PIN diode attenuation for high overload tolerances.

The counters are packed in rugged, high temperature, impact resistance polyphenylenoxide cases with full screening against electromagnetic interference. The instruments run on 115 or 230 V ac at 50 to 60 Hz or from an optional internal battery pack for up to five hours continuous use.

COMMUNICATIONS

Ten metre FM rig

Now with FM operation on 10 metres it is possible to enjoy the thrill of low noise communications that has been so popular on two metres for many years, but with the additional advantage of being able to work overseas DX.

The Comtronix FM-80 is a fully synthesized transceiver that runs 10-15 watts output over the frequency range 28.91 to 29.70 MHz in 10 kHz steps. FM deviation is 3 kHz.

It can also be made to cover 28.01 MHz to 28.80 MHz.

Channel number is indicated by a bright LED readout. Other features include hi-lo power switch to reduce Tx power to one watt for local conversations, adjustable squelch for muted standby operation and an illuminated meter reading S units and transmitter power.

The FM-80 represents a brand new concept and opens many new horizons for the Australian 10 metre operator, horizons that overseas hams have been enjoying for some years now.

The price of the FM-80 is $289. For more information contact the Australian distributors, GFS Electronic Imports, 15 McKeon Road, Mitcham, Vic. 3132; (03) 873-3939.

Popular signal generator

Leader have been well-known for many years for their range of low cost signal generators. Popular amongst their latest range of low cost test equipment is the LSG16 RF signal generator.

It has five frequency ranges covering from 100 kHz to 100 MHz on fundamentals and up to 300 MHz on harmonics. Internal AM modulation is available from a 1 kHz oscillator. An external modulation input is also provided. RF output may be varied by a course attenuation switch and a variable control.

Provision is available on the front panel to plug in D-type crystals for calibration or checking purposes on frequencies from 1 MHz to 15 MHz.

With a recommended price of $118 the LSG16 should appeal to keen hobbyists and technicians.

Vicom are the Leader agents and the LSG16 RF signal generator is available through Radio Parts and Magraths in Melbourne, Radio Despatch Service in Sydney, International Communications Systems in Adelaide, Delsound in Brisbane and Atkins Carlyle in Perth.

Clubs

The Ipswich and District Radio Club will be host to the 1979 Wireless Institute of Australia Queensland Division Convention to be held on the 17th and 18th of November, 1979.

The venue for the Convention is the Ipswich Showgrounds where a diversity of activities will be available. In addition to the usual convention attractions, the weekly trotting meeting is held on the Saturday and, on Sunday, flea markets and auctions present a popular diversion for the families.

There will be competitions, technical seminars "swap shop", equipment auctions, films, and demonstrations, for both the OM and the XYL.

The dinner dance on the Saturday evening will be held in a very pleasant informal atmosphere and will only cost a very reasonable $10.00 a head, which includes registration for both days. The Convention will attract a registration fee of $1.50 for either Saturday or Sunday or $2.50 for both days.

Contact R. Jehn, Public Relations Officer, Ipswich and District Radio Club, P.O. Box 250, Ipswich, 4305, Qld.

PREDICTIONS

DECEMBER 1979

Covering 3 to 40 MHz, these predictions show the times radio contact is possible between the areas designated beneath each graph, as well as the possible 'mode' and reliability. Vertical columns indicate time — commencing at 0000 UT on the left, to 2300 UT at right. For reliable predictions follow the times and frequencies indicated by the F character.

Complete information on using these predictions can be obtained by sending a stamped, self-addressed envelope to:-

ETI — Predictions
3rd floor 15 Boundary St
RUSHCUTTERS BAY NSW 2011.

These GRAFEX style computer generated predictions are provided courtesy of the Australian Ionospheric Prediction Service.

KEY TO SYMBOLS

A blank area means no normal propagation is possible.

% . . . . . path open 50 - 90% of days in month.

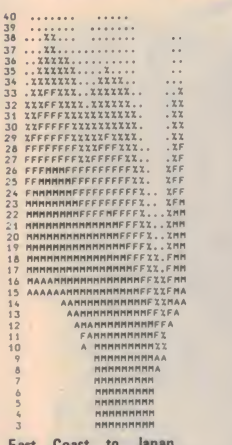
F . . . . . path open at least 90% of days in month.

B . . . . . propagation possible via E and F layers over 90% of days. Overrides 'F'.

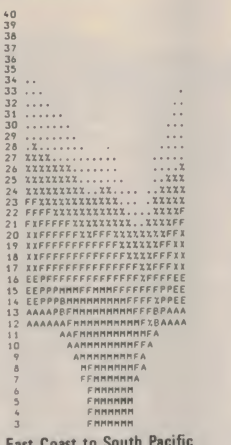
M . . . . . propagation possible by both 1st and 2nd F-layer modes. Expect strong fading.

S . . propagation possible by 2nd mode (also 3rd and mixed E and F modes). Expect strong fading, weak signals.

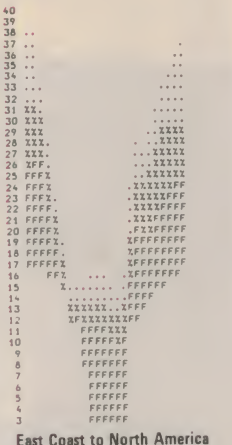
A . . . . . .High absorption indicated. Expect weak signals.



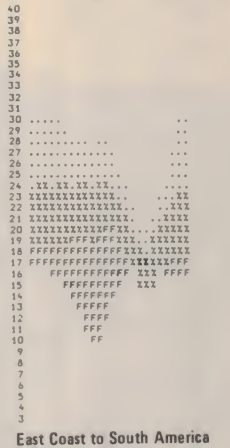
East Coast to Japan (Also serves N.E. and S.C.)



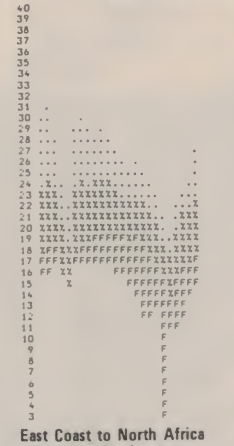
East Coast to South Pacific



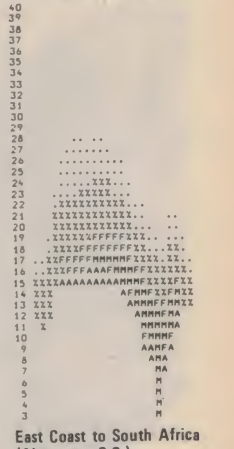
East Coast to North America (Also serves N.E. and S.C.)



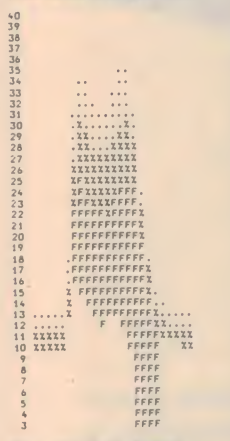
East Coast to South America (Also serves S.C.)



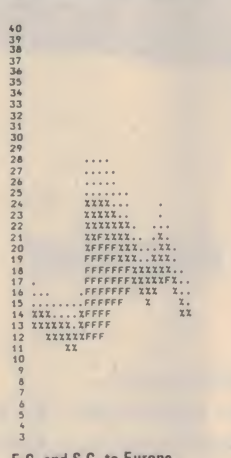
East Coast to North Africa (Also serves S.C.)



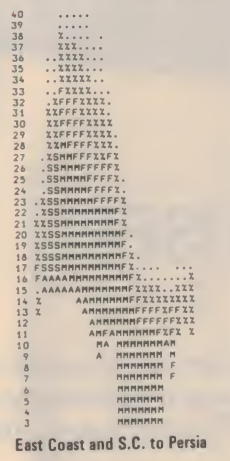
East Coast to South Africa (Also serves S.C.)



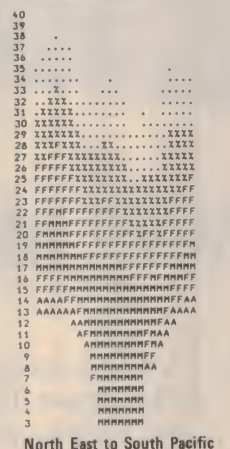
East Coast to Europe (Short Path)



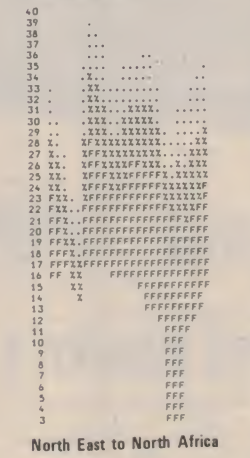
E.C. and S.C. to Europe (Long Path)



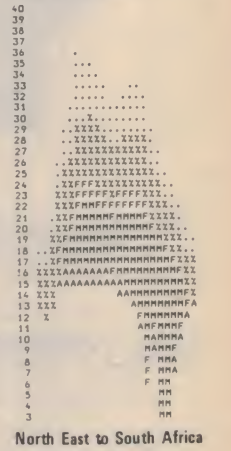
East Coast and S.C. to Persia



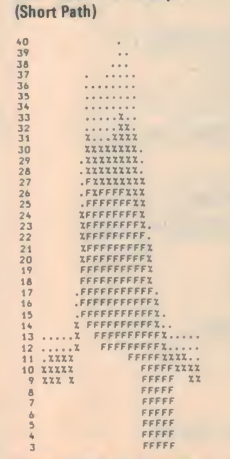
North East to South Pacific (Also serves S.E.)



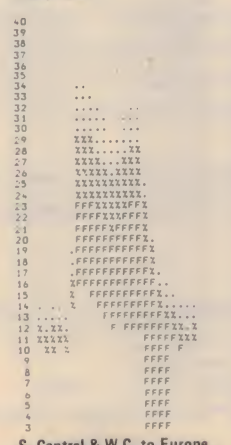
North East to North Africa



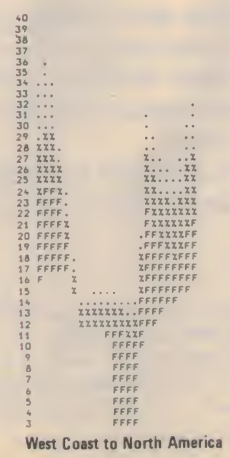
North East to South Africa



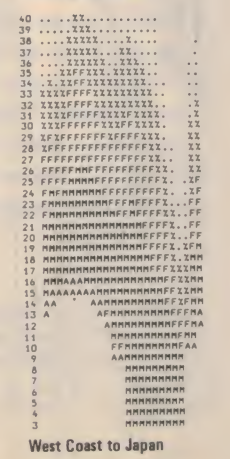
North East to Europe (Short Path)



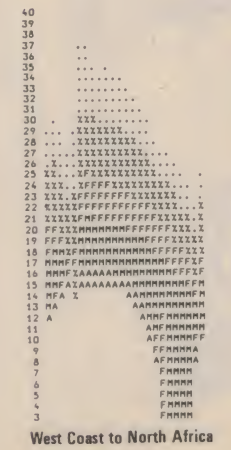
S. Central & W.C. to Europe (Short Path)



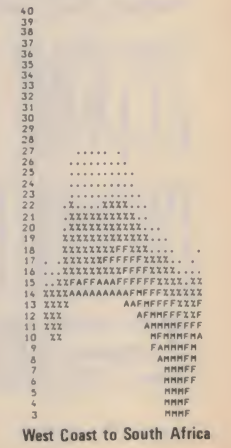
West Coast to North America



West Coast to Japan



West Coast to North Africa



West Coast to South Africa

PERREAUX ADVANCED SOUND EQUIPMENT

Professional **POWER MOSFET** Amplifier

Why **POWER MOSFET** ?

- A new development in transistor technology.
- PMF's have a negative temperature co-efficient. This means that thermal shut off problems and noisy thermal protection devices are eliminated.
- PMF's have no slew rate limiting, giving better transient response, no phase shift and therefore no Intermodulation Distortion.
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For further details and distributor list, contact:-

zephyr products

70 Batesford Road,
Chadstone, Vic., 3148.
Phone: (03) 568-2922

Features of the Perreaux Professional POWER MOSFET power amplifier
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- 10HZ — 100KHZ ± 0.1 dB Frequency Response at rated output
- less than 0.006 percent Total Harmonic Distortion at 190W 8 ohms at 1KHZ

The SX-100 VHF/UHF scanning receiver

A sophisticated solid-state receiver featuring push-button operation, programmable memory and wide frequency coverage in 5 kHz channel steps.

Roger Harrison VK2ZTB

WIDE COVERAGE VHF/UHF receivers are designed to allow an interested listener to 'eavesdrop' on the commercial, semi-government, government and amateur bands in that region of the spectrum used for general 'local' communications.

These receivers are predominantly aimed at the American market as interest there in "scanning" the VHF/UHF spectrum has boomed in recent years.

As the receivers are required to cover a comparatively enormous frequency range, and the bands of interest have the services allocated in channels with spacing ranging from 10 kHz to 100 kHz, conventional tuning proves impracticably cumbersome. As a consequence, electronic channel 'stepping' – or "scanning", as it is more commonly referred to – is employed. A number of fixed channels may also be provided, so that favoured frequencies of interest may be returned to easily.

There are some seven or eight brands of VHF/UHF scanning receivers being offered on the American market, which is some indication of their popularity.

The unit reviewed here is made by the Japanese J.I.L. company who make a wide range of, generally, consumer electronics items; car radios, CB transceivers, digital clocks etc. Their major market outlets seem to be in Asia and the USA. The SX-100 is imported by GFS Electronic Imports of 15 McKeon Road, Mitcham Vic 3132 (03)873-3939.

Features

The SX-100 is designed for FM reception and covers three bands, in 5 kHz channel steps: 30-53.995 MHz (4 800 channels); 140-179.995 MHz (8 000 channels) and 410-513.995 MHz (20 800 channels). It features manual frequency selection via a keyboard on the front panel, scanning of all channels at two selectable rates, a 16 channel memory (which can also be scanned), digital frequency read-out, digital clock and 12 Vdc or 240 Vac operation.

Frequency selection is entirely digitally controlled, including the memory channels – no crystals are required. An LSI controller chip interfaces the keyboard and display with the phase-locked loop (PLL) local oscillator.

The unit has two 'front ends', one covering the VHF range, the other, UHF. Diode switching selects which is used depending on what has been entered on the keyboard or in the memory, and each stage is varicap tuned by the PLL. Cunning, and seemingly effective.

Overall, the receiver is a conventional double-conversion superhet, having a 10.695 MHz first IF followed by a 455 kHz second IF then detector, squelch and audio.

In the scan mode, the receiver steps from channel to channel, stopping when a signal strong enough to open the squelch is encountered. It will continue to scan when the signal disappears. However, the receiver can be made to 'hold' on the channel for a period after a signal goes off. The 'scan delay' control allows the setting of this hold period, before scanning recommences, between zero and four seconds.

Operation of the 'memory' is straightforward and includes some convenient features. A frequency may be 'dialled up' on the keyboard and entered into memory by pressing the MW button ('memory write') and one of the memory buttons (ranged along the top of the receiver). If you want to enter the frequency of a channel you are listening to then it's a simple matter of pressing the MW and one of the memory buttons. The memory buttons may be used in any order. If you want to scan the channels entered in the memory, you have two options: you can scan all of them or only selected ones. The 'Scan A' button above the power switch sets the unit scanning all memory channels, from M1 to M16. The 'Scan B' button allows scanning of only selected memory channels (using the SW button).

Next to the 'Scan A' button, you may have noticed the 'Seek' button. This provides for general scanning of the three bands. You can set the unit scanning the whole of each band or have it commence at a particular frequency. With the squelch set 'open' the receiver will step up 5 kHz in frequency each time this key is pressed. A handy facility for manually searching over a small frequency range.

During any of the scanning operations, the scan may be stopped simply by pressing the ST button on the keyboard. Speed of scanning may be varied by pressing the SP button. The unit will always scan at the rate of four channels/second for Scan A or Scan B, five ch./sec. for Seek. When the SP button is pressed it will scan at twice that rate, returning to the slower rate when pressed a second time.

The ST button does double duty. When manually entering a frequency on the keyboard, the decimal point between the MHz and kHz digits is entered by pressing the ST button.

The display uses seven-segment fluorescent indicators. When powered up, the display reads "A 12-00" and the receiver will be set to 162.400 MHz, the American "weather" band channel. In normal operation the display will always show the time in hours and

minutes. To display the frequency being monitored, the FR key is pressed. After five seconds, the display reverts to the time indication.

One can't help but think that the purpose of this is to 'hide' the frequency of interest from the casual, suspicious, observer. Hmmm.

The channels entered in the memory, according to the handbook supplied with the unit, will be retained for a maximum of one hour after the unit is switched off. In actual fact we found it was greater than 24 hours! That may be just a peculiarity of the unit reviewed, nevertheless, it's pretty startling. An internal mercury cell is used to supply the memory when the receiver is switched off.

Evaluation

On the telescopic antenna supplied, I could receive, from inside a re-inforced concrete building in a "not good" location at Rushcutters Bay, a whole host of signals at good strength. The Sydney channel 8 amateur repeater (on 147 MHz), about 30 km away, was noise free. Listening to the input frequency (146.4 MHz), I could hear mobiles running 10 watt transceivers at Auburn and Pymble (about 8-10 km away). That's quite respectable performance. Tootling up to the UHF CB band (around 477 MHz) I could hear a few mobiles, but not as well as on the two metre amateur band – which is what I would expect.

It took about half an hour to learn to 'drive' the SX-100, the handbook is written in the typical, curious "Japanese-English" one commonly sees with products from that country, and this delayed the learning process somewhat. The handbook leaves much to be desired.

To see what it would do on a decent antenna, I took the unit home and hooked it up to my log-periodic VHF antenna (an ETI-714, Feb. '78). I was amazed! Of the signals that could be identified, I could hear amateur 2m repeaters as far distant as about 150 km and UHF CB base stations up to 100 km away. TV stations provided some interesting results. Channel 0 in Wagga was audible as were two New England region stations. Admittedly they're relatively high power transmissions, but the distances are around 200 km. Sensitivity, as suspected, was clearly very good.

The limited specifications given by the manufacturer give the sensitivity figure as "0.5 uV", without quoting S/N ratio or quieting. On the test bench, for 20 dB of quieting, the receiver required a little under 0.2 uV on the VHF bands and around 0.3 uV on the UHF band. Not bad at all.

Frequency accuracy is not quoted by the manufacturer, but setting the signal generator to a spot frequency and then dialling it on the SX-100 brought up the signal spot on every time. Adjacent channel rejection could not, for practical reasons, be measured but seems only fair. However, in Australia services are not spaced as close as 5 kHz and little problem should be experienced.

Some services have 12.5 kHz channel spacings – which raises a potential tuning difficulty as, at worst case, you could only dial up a channel either side of the desired one. Some distortion results.

In general, the audio quality is adequate, but an external speaker improves matters. No 'birdies' were detectable through the tuning range of the receiver. A quantitative measure of image rejection could not be taken but it seems some strong signals could cause trouble.

As the unit is meant for mobile use as well as home or base installation, it seems the speaker placing was chosen to favour the latter as it is mounted on the top panel of the case. An external speaker is recommended for mobile installations.

Conclusion

Overall, the SX-100 does its job very well. I would have liked to have seen a 'proper' coax socket for the antenna connection – like a BNC type at least – and perhaps both AM and FM demodulation as there are many services still using AM transmission (the aircraft band for example).

For the enthusiastic radio amateur or some organisation requiring monitoring facilities in the VHF/UHF range, the SX-100 would seem worthy of close consideration. ●

ARE "SCANNERS" LEGAL ?

There seems to be some question as to the 'legality' of a person owning and using receivers of this type. Providing the units cover a 'broadcast' band (i.e: TV or the FM band, or part thereof) then, apparently, they may be openly offered for sale. As we understand the situation, if subsequently the owner uses the receiver in a manner prejudicial to the security of communications (e.g: police transmissions) then he would be committing an offence under the Wireless Telegraphy Act and Regulations. Prosecutions of tow truck operators monitoring police broadcasts in order to obtain business from accident reports have been successful.

However, the whole issue is in somewhat of a 'grey' area with regard to the Act and is unlikely to be resolved until the legislation is rewritten.

An amateur licensee would seem to have 'legitimate excuse' to possess a "scanner", although a Novice may have difficulty explaining it. We are aware of some semi-government organisations that use them as monitors for their own communications networks and some news-gathering services that use them for purposes we shall leave to your imagination.

This sort of technology throws into focus the inadequacies of existing legislation concerning communications. Issues surrounding the ethics, morality and legality of the use of these receivers are far too complex to discuss here – but correspondence is welcomed. Write to the Editor.

sound

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Teac 'Portastudio' — new concept in recording

Teac Australia have announced the release of a totally new and unique product — a multitrack recorder/reproducer which records on standard cassettes, rather than open reel tape.

The Model 144 Portastudio was unveiled by Mr Gavin Muir, General Manager of Teac Australia Pty Ltd, with Mr Y. Ikeda and Mr M. Mitsunobu of the Teac Corporation, Tokyo, at a press reception at the Sydney Hilton. Mr Mitsunobu, who is largely responsible for implementing the Portastudio, explained the concept behind the design.

The Portastudio is a complete multitrack recording facility, consisting of a four channel mixer and four-track recorder, in a single compact package measuring only 460 mm x 370 mm x 120 mm and weighing in at just 9 kg.

In developing the system, TEAC has made several major advances in recording technology, not the least of which is the miniature four-track record/reproduce head. The signal to noise ratio and frequency range have been optimised by increasing tape speed to 9.5 cm/sec (variable, plus and minus 15%), and by the inclusion of permanent Dolby noise reduction, resulting in a signal to noise ratio of 50 dB (weighted) and a frequency range of 30 Hz — 15 kHz with Maxell XL-II or TDK SA tape, according to TEAC.

Track-to-track crosstalk is quoted as better than 50 dB at 1 kHz in reproduce mode, and better than 15 dB across adjacent tracks in sync-overdub mode.

The mixer section will accept up to four microphone or line inputs — channel preamplifier gain is continuously variable from mic level to line level — and a push-switch associated with each channel selects either mic/line input or the off-tape signal for sync-overdub.

The active bass and treble tone controls, pan pots, and channel faders are operative in both modes.

The Portastudio is intended as a low cost multitrack facility for musicians and amateur recordists, generally, and although it is not strictly a true four-track machine (only two tracks can be recorded simultaneously), up to ten vocal or instrumental parts can be recorded using the 'ping-pong' technique of mixing down two or three recorded tracks onto a spare track. Complete monitoring facilities, including a four channel mono cue mix, allow full use of the sync-overdub capability for recording additional tracks in synchronism with tracks already recorded.

While it would be preferable, in many situations, to record all four tracks simultaneously, the Portastudio will nevertheless be an extremely useful tool for producing quality demonstration tapes and for experimenting with arrangements. It will be particularly useful for electronic musicians.

The Teac Model 144 Portastudio is available from Teac/Tascam dealers for $1000, plus sales tax where applicable.

New Empire from Concept

The EDR9 is Empire's latest cartridge since the 2000 series released in 1973.

The new cartridge features an "inertially-damped, tuned stylus" moving system with claimed rise time of 12.5 microseconds.

Empire quote a frequency response of 20 Hz to 35 kHz within plus/minus 1.75 dB. The "large area of contact" (LAC) stylus used in the EDR9 has two important benefits, according to Mitch Ravitz of Empire. He says, firstly, it is a stylus shape that results in minimum loss of high frequency information. Secondly, it gives an 80% reduction in record wear.

The EDR9 uses the same variable reluctance system as used in other Empire cartridges, with the nude-mounted stylus and gold-plated terminal pins.

Another new cartridge has been added to Empire's 2000 series — the 2000X. It also features the inertially-damped, tuned stylus technique as the EDR9 and comes with a nude-mounted (Diasa type) 0.2 x 0.7 elliptical diamond stylus on a tapered cantilever tube. It has been designed to track in the range 0.75 to 1.5 grams and can be used anywhere the 2000E/III is used.

The 2000X is priced at $89 retail while the EDR9 is $275 retail.

For a listening test or more information, contact Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale NSW 2100. (02) 938-3700.

Sanyo move

Sanyo Australia moved to their new national headquarters on 2nd October, at 225 Miller St, North Sydney NSW 2060.

Their new phone number is (02) 436-1122.

Sanyo have transferred their corporate headquarters from Melbourne to Sydney and their marketing head office from Lane Cove to the North Sydney address. The new headquarters also houses Sanyo's administration, finance and computer operations.

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SA	– 128 Main North Road, Prospect. 269 2544

sound news

Gusdorf electronics furniture

The Acoustic Monitor Company are marketing the US-made range of Gusdorf 'electronic furniture' here.

Designed to accommodate a wide range of styles and sizes in hi-fi gear, the furniture is robustly built and comes in both ebony and rich walnut tone finishes. The 'Rendura' (registered trademark) surface "eliminates scratching, abrasions and stains". Tempered glass doors provide protection for equipment and records housed inside the cabinets. Prices range from around $130 to $300.

For more information, contact the Acoustic Monitor Company, 12-18 Gould St, Enfield NSW 2136. (02) 642-7888.

Hi-fi for the car — from Pioneer

Prominent on Pioneer's stand at the July CE Show in Sydney was their range of car stereo components which included cassette players, tuners, equalisers, amplifiers and speakers.

The range was released in August, a good example of the components being the 'System 6'. This is comprised of a multi-mode cassette deck, an equaliser and stereo amp.

The equaliser has boost and cut controls at 60 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz and 10 kHz. A front-rear and echo control on concentric shafts is provided also.

The SK-6 cassette deck has a 10 W output (music) power rating, chrome tape facility, stereo width control, separate bass and treble controls, auto repeat, one-touch record and monitoring in fast forward and rewind. Bandwidth is quoted as 50 Hz to 10 kHz on standard tape, extending to 12 kHz at the top end for chrome tape. Recommended retail is $259.

For more information, contact Pioneer Electronics Australia Pty Ltd, 178-184 Boundary Rd, Braeside Vic 3195. (03) 90-9011.

Philips' "Direct Control" stereo player.

The Philips model AF 977 stereo record player features a belt-turntable having a built-in tachometer which is part of a phase-locked loop speed control system, combining the advantages of belt drive with direct-drive PLL systems.

Philips claim the AF 977 easily exceeds the requirements of the DIN 45 500 specification, achieving a very high standard of performance. Rumble is quoted as -73 dB (DIN B) and wow and flutter as less than 0.025% (weighted RMS).

Features of the player include: shock-proof free-floating subchassis; straight, tubular-aluminium tone arm with decoupled adjustable counterweight and low friction bearings; light, detachable headshell with Super M Mark II GP 412 cartridge; auto diameter selection and arm positioning; photo-electronic automatic stop, arm lift and return; hydraulically damped arm lift; anti-skating adjustment for spherical, elliptical and CD-4 stylii; direct read-out of stylus force; touch speed selection, auto and stop controls and digital speed readout.

More information is obtainable from Philips Consumer Products, 1092 Centre Rd, Clayton Vic 3168.

Hi-fi Association elections

The following were elected officers of the High Fidelity Industry Association for the 1979/1980 year:

Chairman: Les Black, Pioneer Electronics Aust. Pty. Ltd.
Vice Chairman: Peter Lee, National Panasonic (Aust) Pty. Ltd.
Promotion Executive: John Watts, Superscope (A'sia) Pty. Ltd.
Secretary Treasurer: Graham Timmins.

Members of the Association at 1st July are:-
Audio Reflex (Australia) Pty. Ltd.
AIWA Australia Pty. Ltd.
Akai Audio/Video Australia Pty. Ltd.
Audio Engineers Pty. Ltd.
B.J.D. Electronics Pty. Ltd.
Convoy International Pty. Ltd.
The Falk Electrosound Group
Hagemeyer (A'sia) B.V.
Harman Australia Pty. Ltd.
Hitachi Sales Australia Pty. Ltd.
National Panasonic (Australia) Pty. Ltd.
Pioneer Electronics Australia Pty. Ltd.
Philips Consumer Products Pty. Ltd.
Pye Consumer Products
Rank Industries Australia Pty. Ltd.
Rose Music Pty. Ltd.
Sanyo Australia Pty. Ltd.
Sharp Corporation of Australia Pty. Ltd.
Sony (Australia) Pty. Ltd.
Superscope (A'sia) Pty. Limited
TDK (Australia) Pty. Ltd.
TEAC Australia Pty. Ltd.
Toshiba (Australia) Pty. Ltd.
Vanfi (Australia) Pty. Ltd.
W.C. Wedderspcon Pty. Ltd.

The 4th Australian Consumer Electronics Show which was sponsored by this Association was held at the Sydney Showground on the 14th-22nd July 1979. The Show was attended by 2 000 people from the retail trade while the public attendance was 20 000.

Arrangements are under way for the 5th Australian Consumer Electronics Show which will be co-ordinated by John Watts of Superscope (A'sia) Pty. Ltd.

sound briefs

Lecson in trouble

We hear that the UK's Lecson audio manufacturing company has gone into receivership. Gale is said to be interested in taking over . . . our info is from a normally reliable source but we do not have positive confirmation . . . and Lecson's phone is not being answered.

Guess which

One of Britain's trendier power amps, recently rated by one of that country's equally trendy reviewers as 'second only to the Naim' — and currently touted as representing the absolute state of the art — has circuitry identical **to the very last resistor** of that published as an application note by RCA in the late sixties!

On a vaguely similar theme, did any of our lynx-eyed readers spot that tuner review in a pommy hi-fi magazine which (twice) quoted tuner sensitivity as being 0.03 uV — a figure which could only have been achieved by immersing the thing (antenna and all) in liquid nitrogen!

Strathearn latest

Rumours that Aiwa are to take over the wound-up Northern Irish Strathearn Audio company are unfounded. Aiwa considered using Strathearn to manufacture Aiwa equipment a year or two ago but abandoned the project in February 1979. Aiwa are now planning to establish a plant in the UK to produce virtually the full range of Aiwa equipment, (Aiwa is a subsidiary of Sony — but operates as a rival company!).

Auto-tune

Philips has developed a microcomputer controlled FM car radio that automatically retunes the radio whenever the car travels beyond the range of the FM transmitter to which it was originally tuned — selecting another stronger station broadcasting the same signal (it is common in Europe to have a multiplicity of transmitters broadcasting the same material).

The microcomputer has a read-only memory which stores up to 60 FM station frequencies — 10 frequencies for each FM programme. We understand that the new radio will be on sale in April/May next year.

Dolby HX challenge

Norway's Tandberg company has released details of a new tape recording system developed to cut distortion introduced when recording high level, high frequency sounds.

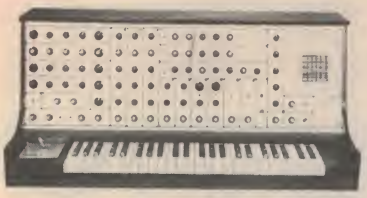
Cassette recordings are currently made using substantial boosting of the upper frequencies. This is necessary in order to compensate for the relative insensitivity of the slow moving tape at such frequencies.

Whilst effective for most material, the technique cannot adequately accommodate material containing large amounts of loud high frequency sounds — in such instances the added high frequency boost tends to overload the tape resulting in distortion.

Tandberg's new technique — known as Dyneq — ensures that the high frequency boost is added progressively: the amount being reduced when the material contains too much high frequency content for the tape to cope with.

Although a slight amount of programme content is occasionally lost, the overall sound is claimed to be subjectively more acceptable.

JAYCAR Pty. Ltd. — AUDIO KITS and COMPONENTS



4600 Synthesizer

This superb Studio Synthesizer offers unlimited flexibility. It utilises a Patchboard for rapid programming. Also features the "Fairlight" digital keyboard.

489 Spectrum Analyser

This 10 band LED display analyser can be used in conjunction with most equalisers for accurate acoustic compensation.

485 Graphic Equaliser

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- Level match control for each channel
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- 3 pre-set voices on lower keyboard
- Variable Attach and Decay
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414 Master Mixer

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1.

2.

3.

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Sansui AU-417 stereo amplifier

THE CATCH CRIES amongst amplifier manufacturers at the moment are slew rate, minimum linear distortion and low transient intermodulation distortion (TIM). This may be all very well for the manufacturer, but with performance specifications becoming better every day and rapidly reaching the level of superlatives, the reviewer is beset by a new range of problems. Possibly the most disturbing of these is that instrumentation that used to be good enough for testing such equipment has now reached the point of obsolescence.

Over the last six months we (and we must presume many others in our position) have been faced with the problem of relegating virtually all our old laboratory equipment suitable for measuring the parameters that the new generations of amplifiers, tape recorders, record players and speakers are producing.

The AU417 is a particularly good example of where technology is going at the moment and it does so under the banner "black is beautiful".

Features

The AU417 amplifier is a striking piece of equipment. The controls are laid out in two rows with the top row following a conventional layout. It has a light indicating "operation of the power protection circuitry" on the left, a speaker selection switch providing for speakers "off" and for either or both of the two speaker systems. Next is a treble control graduated in increments to ±10 dB at 10 kHz on the left hand side. On the right hand side there's a very large mechanically indented volume control marked from zero to 100 in 20 steps. On its right is a smaller input selector knob for auxiliary, tuner, phono 1 and phono 2 selections.

The bottom row of controls comprises the left power on/off switch, a stereo headphones output socket, bass control with +10 to -10 in 2 dB steps at 20 Hz. Centrally located is a tone control defeat switch, a 16 Hz subsonic filter switch, and a loudness on/off control switch. The balance control has been placed immediately below the volume control. Under the main input selector are three push buttons for source, tape 1, tape 2 and a tape play control for selecting tuner, source and tape duplicate 1 to 2, and 2 to 1.

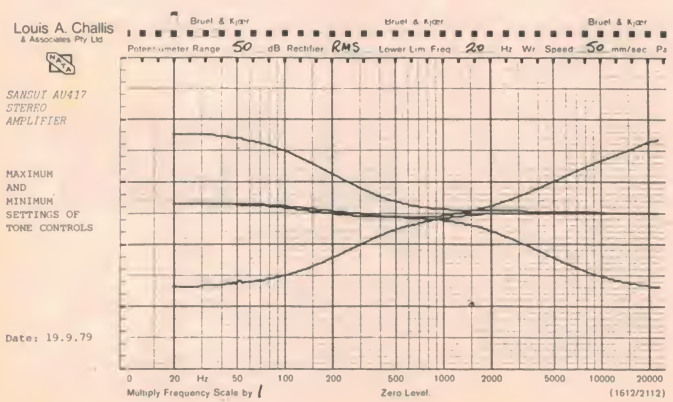
The controls are sensibly laid out, with careful thought to ergonomics, and engineered for ease of handling. Sansui have cleverly designed a set of removable plastic handles and mounting brackets which may be fitted to allow installation in a standard 19" rack.

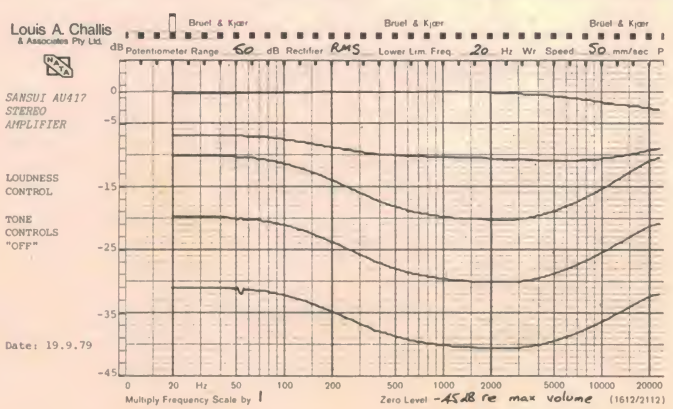
The rear of the amplifier features coaxial input sockets for phono 1, phono 2, tuner and auxiliary input, tape 1 record and play and tape 2 record and play. The panel also sensibly incorporates a grounding terminal for record players. The speakers are connected by effective lever control sockets for insulated leads to speaker systems A and B respectively.

The inside of the amplifier is a delight to behold – with a beautifully engineered sub-chassis inside the main chassis. This supports the power transformer at the left rear of the amplifier and the power supply and its associated protection board mounted vertically beside it for optimum cooling. The power supply board holds a large number of components including two stages of protection. The first of these is a dc voltage detection circuit and quick acting relay. The second is an overcurrent detection circuit to maintain the amplifier in a safe operating area for each set of power transistors. A 3½ Adc fuse is mounted in a semi-inaccessible location at the bottom of the protection board.

Sansui take the attitude that if this last line of defence fails, then something potentially more dangerous than can be corrected by the normal user has occurred and that rectification by a skilled service technician is called for. When the amplifier is switched on there is an intentional five second delay before the voltages are fed to the output. During this time the bezel light flashes on and off indicating that the unit is not yet ready to be used.

The large power amplifier modules are provided with effective side screens of steel. Each is designed as a simple screwed-in module, directly connected and wired to the power output transistors on each heat sink. These are beautifully made and have more the appearance of professional equipment than the usual consumer electronics type construction. Sansui have obviously given a great deal of thought to optimising the cooling circuit paths





around the heat sinks and it is clear that the design of this particular amplifier chassis and hardware has been standardised to cover a wider range of power amplification capabilities than that required by the AU417 alone.

On the right hand side of the power amplifier the designers have located a preamplifier board incorporating remote extension switching from the front panel. This makes effective use of the side of the amplifier cabinet as one of the screens of the preamplifier to provide positive overall screening. This large printed circuit card is connected to the input sockets by a good example of parallel screened cables.

The construction of this unit is one of the best examples of consumer electronics that we have seen. The rear of the front panel of the amplifier incorporates very little circuitry and this consists primarily of the tone control circuitry, the loudness control, volume control, balance control circuitry and the output wiring for the speaker selector switch. The mains power on/off switch is fitted with a VDR to minimise voltage turn on transients. The overall impression that one has from the internals of the amplifier is that it is well constructed, to a high professional standard and that the designers have given careful consideration to performance, servicing and ventilation.

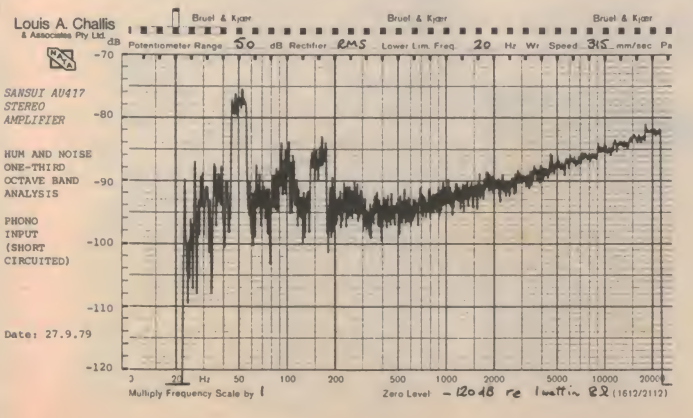
Evaluation

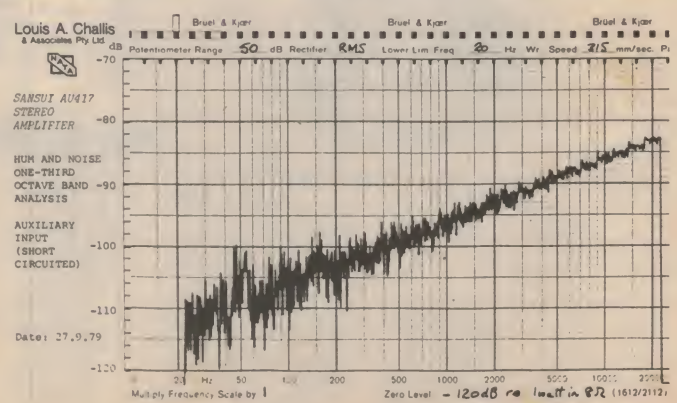
The frequency responses with the tone controls centred covers a range of 2 Hz to 95 kHz for the left channel and 2 Hz to 99 kHz for the right channel at the -3 dB points. Surprisingly, but in keeping with what we have come to expect, this frequency response changes to 2.4 Hz to 78 kHz for the left channel and 2.2 Hz to 81 kHz for the right channel with the tone control defeat circuit in use.

The sensitivity and overload performance of both the phono inputs and auxiliary inputs are excellent and well exceed the manufacturer's specification. The output impedance of the unit is a very conservative 0.22 ohms (independent of frequency). When we came to the area of harmonic distortion even our new equipment approached the limits of its performance. The harmonic components ranged from 87 dB down to better than 120 dB down and indicated that the overall linear distortion performance of this unit is significantly better than the manufacturer's literature would indicate.

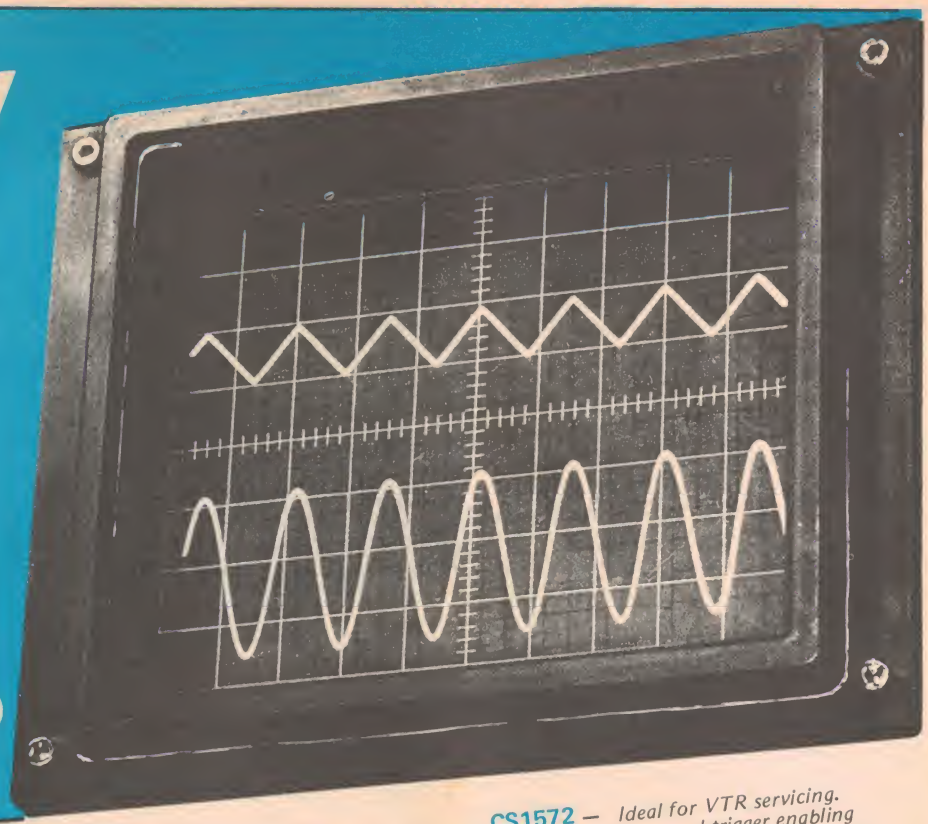
At the rated 65 W output, whilst the manufacturer claims figures ranging between 0.09% and 0.29% we were measuring total harmonic distortions ranging between 0.003% and 0.005%. These are impressive figures and come directly as a result of innovative electronic design. There are other attributes over and above the excellent steady state distortion characteristics. In particular, the transient intermodulation characteristics of this amplifier are superb and equal to the best of the amplifiers we have recently reviewed.

The noise and hum levels, whilst excellent, are not superlative. They are however, good enough to satisfy the most serious audiophile and many professional applications as well. The maximum output power at the clipping point is 115 W into 8 ohms indicating a dynamic headroom of 2.5 dB relative to the manufacturer's 65 W rating for the amplifier. The hum and noise from the main power amplifier is dominated by high frequency transistor noise and it is worth noting that the mains component and second harmonic of the mains are typically more than the 100 dB down relative to the 1 W power ▶





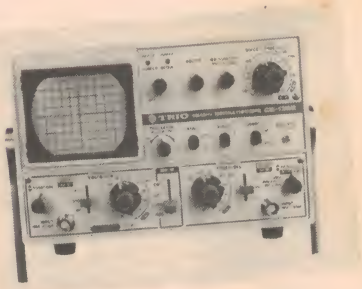
A NEW TRIO from TRIO

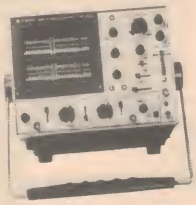


CS1352 — *Ideal for field use. Completely portable, AC, DC and battery operation. Dual trace 75mm display. DC–15MHz bandwidth and 2mV/div sensitivity plus triggered sweep. Features auto free-run for convenient voltage measurements and wide bandwidth for Lissajous phase measurements.*

CS1577 — *A laboratory instrument with widest 30MHz bandwidth. Dual trace with a sensitivity of 2mV/div — ideal for low level signals. Max. sweep time is 0.1uS/div for measurement of fast rise time pulses. Auto-level (FIX) eliminates time consuming sync adjustments, plus auto free-run.*

CS1572 — *Ideal for VTR servicing. Features video delayed trigger enabling sweep to start at any point on any single video frame. Plus expansion of intricate signals for easier analysis. And a capability to separate odd and even video fields. 5mV/div sensitivity and DC to 30MHz bandwidth. Has FIX and auto free-run. The scope for video pulse and digital work.*





PLUS AN UPDATE FOR THE POPULAR CS1560A

CS1560A MK II — *has improved IC circuitry and a new CRT with electronic trace rotation and provision for a camera. Still provides 10mV/div sensitivity with 15MHz band width and sweep times to 0.5uS/div. Auto free-run for making voltage measurements and wide bandwidth for accurate Lissajous phase measurements. The most popular scope for TV, lab, educational and general use.*

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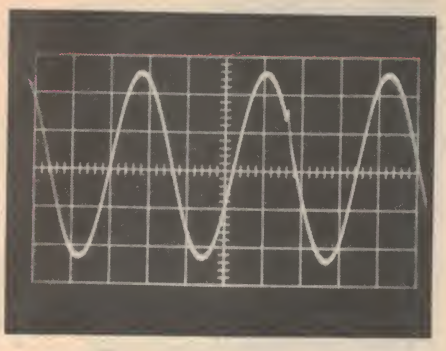

AU417 transient intermodulation (T.I.M.) test performance.

output level. This amplifier will, as a consequence, produce far less speaker hum than many more expensive amplifiers that we have evaluated . It will, however, produce a just audible hiss when the volume control is turned fully clockwise and with one of your ears placed up against the speakers.

With the volume control down at normal listening levels the hiss from the speakers will be completely inaudible. The other objective test which highlights the performance of this amplifier is its response to a transient overload. The photos show this to be impeccable and the unit did not exhibit any visual signs of instability whatsoever. The amplifier comes so close to theoretically optimum performance that it borders on what could be currently considered as laboratory standard.

Summary

The subjective evaluation of the Sansui AU417 amplifier was in many respects superior to the objective tests. The amplifier provides what can only be described as zero subjective colouration for the programme content which it amplifies. It also provides sufficient normal power and peak power to satisfy almost any domestic situation. We played a wide range of speakers, ranging between Quad electrostatics at one end of the spectrum to JBLs at the other and found that these speakers, and a number of others of differing sensitivities and capabilities, responded remarkably well to the AU417. Even less august speakers sound very clean (but not necessarily uncoloured) when driven by the AU417. Without exception, signal to noise levels were determined by the programme content and not by the amplifier. Thus the amplifier is markedly better than the source material which it is handling.

The AU417 offers a technical performance which can only be described as state of the art and has technical attributes including quality construction which belie its remarkably low price of $399. This amplifier offers performance which only amplifiers selling at around twice the price have previously achieved. ●

THE SANSUI AU417 INTEGRATED AMPLIFIER, SN 229021419

Dimensions: 430mm wide x 168mm high x 395mm deep
Weight: Net 12.2kg Price: $399
Manufactured by Sansui, Japan.

MEASURED PERFORMANCE OF
SANSUI AU417 STEREO AMPLIFIER, SN 229021419

FREQUENCY RESPONSE:	Left:	2Hz to 95kHz		
(-3dB re 1 watt, 0.5V input to Aux.)	Right:	2Hz to 99kHz	(tone controls centred)	
	Left:	2.4Hz to 78kHz		
	Right:	2.2Hz to 81kHz	(tone controls defeated)	
SENSITIVITY:		Left	Right	
(for 1 watt in 8Ω)	AUX.) TUNER) TAPE)	11.4mV	12.7mV	
	PHONO	145µV	150µV	
	OVERLOAD	315mV	315mV	
INPUT IMPEDANCE:		Left	Right	
	AUX.) TUNER) TAPE)	47kΩ	47kΩ	
	PHONO	46kΩ	45kΩ	
OUTPUT IMPEDANCE:	0.22Ω			

HARMONIC DISTORTION:		100Hz	1kHz	6.3kHz
(at rated power 65 Watts in 8Ω - 22.8V)	2nd	-92.2dB	-93.2dB	-87.7dB
	3rd	-94.0dB	-94.7dB	-90.3dB
	4th	-109.5dB	-	-96.1dB
	5th	-	-	-
	THD	*0.003%*	*0.003%*	*0.005%*

HARMONIC DISTORTION:		100Hz	1kHz	6.3kHz
(at 1 watt into 8Ω)	2nd	-87.2dB	-87.4dB	-83.2dB
	3rd	-97.8dB	-98.1dB	-100.3dB
	4th	-108.0dB	-	-
	5th	-	-	-
	THD	*0.005%*	*0.004%*	*0.007%*

TRANSIENT INTER-MODULATION DISTORTION:	1.2% (see photo)		
NOISE & HUM LEVELS:			
(re 1 watt in 8Ω)			
with volume control set for 1 watt output with,	AUX	-76.5dB(Lin)	-79dB(A)
	PHONO	-74dB(Lin)	-77dB(A)
0.5V input (Aux.) 5mV input (Phono)			
inputs short circuited.			
MAXIMUM OUTPUT POWER AT CLIPPING POINT:			
(IHF - A - 202)			
(20mS burst repeated at 500mS intervals)	86V p-p		
.	= 115 watts in 8Ω		
. . Dynamic headroom	= 2.5dB re 65 watts		

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New SUPER COMPO offers the best values in stereo systems of outstanding musicality. Listen and believe!

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The most practical receiver system with a low distortion of 0.09% (40W × 2, IHF Music Power). The same cassette deck as used in the most expensive system is included.

SUPER COMPO 200

This receiver system features higher power (70W × 2, IHF Music Power), Peak Power Level Displays and precision auto-return direct drive turntable.

SUPER COMPO 300

The top-of-the-line DC-Servo receiver system with reserves of clean power (100W × 2, IHF Music Power), Peak Power Level Displays with 12 × 2 LED indicators, and the best fully automatic DD turntable incorporating D-O-B tonearm and computerized operation.

* SUPER COMPO 400

An excellent choice in a complete system with low distortion integrated amplifier (40W × 2, IHF Music Power), quality FM/AM stereo tuner, precision-made tape deck and precision auto-return turntable.

* SUPER COMPO 500

A fine system which incorporates Sansui's DC-Servo amplifier (70W × 2, IHF Music Power) with Peak Power level Displays and a matching FM/AM tuner with LED signal/tune displays.

* SUPER COMPO 600

The most powerful amplifier (100W × 2, IHF Music Power) and the Digitally Quartz-Locked tuner with a computerized direct-drive turntable and D-O-B tonearm make this system highly desirable to both audiophiles and music lovers.

* SUPER COMPO 700

This is the top-of-the-line system — even the internal illuminated cabinet has its own deluxe touches. DC-Servo amplifier (100W × 2, IHF Music Power), Digitally Quartz-Locked tuner and Full-Auto Quartz-Servo DD turntable.

Matching speakers. Wide-range quality speakers systems are available to fully realize the fine features of SUPER COMPO systems.

Audio Cabinets. Each SUPER COMPO system comes with its own audio cabinet specially designed to accommodate the system's components.

*Also available in silver finish.

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Altec Model 15 studio monitor

Featuring an innovative loaded horn tweeter and a 300 mm bass driver in a 750 litre enclosure, the Model 15 provides a " . . . wide frequency response, low distortion . . . an impeccable phase response and unusually good transient performance."

THE MODEL 15 Studio Monitor Lansing Loudspeaker is a good example of how Altec Lansing have been able to retain their leading position in the market place. This model appears to be a conventionally designed two-way speaker system based on the principle of a vented enclosure with a 300mm diameter bass speaker with a horn tweeter providing an extended top end. The drivers are housed in a 750 litre enclosure with the bass driver at the bottom of the speaker and the horn tweeter inserted inside the enclosure immediately above in order to achieve a good flat phase response.

The particle board cabinet is carefully veneered in American walnut. However, unlike the majority of other speakers on the market, the Altec Lansing is veneered on all faces and its overall finish is of the highest furniture standard. In keeping with its primary design concept of a studio monitor, where it would be mounted on wall, the electrical connections are recessed into the bottom face of the cabinet and the front panel is removable to provide access to the separate mid-frequency network equaliser. This provides for a dip in the mid-frequency response and an overall level adjustment on the horn tweeter's output.

The horn driver is an Altec Lansing 33952 and incorporates the innovative Altec "Tangerine radial phase plug" to achieve an extended frequency response to 20 kHz. Whilst nominally designed for monitoring purposes, the Model 15 is still small enough for home use, although its depth and height would make it rather conspicuous.

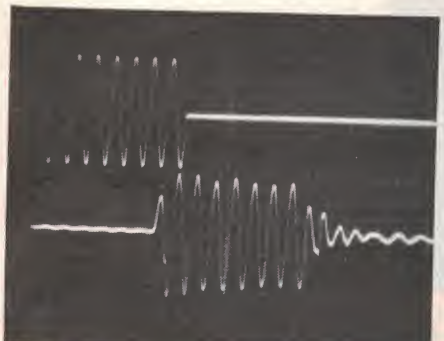
Evaluation

The measured frequency response in our anechoic room showed that the 300mm low frequency driver shows a particularly smooth frequency response over the range 30 Hz to 1.8 kHz whilst the loaded horn tweeter offers a broad, reasonably balanced frequency response from 2 kHz to 20 kHz. The peaks and bumps in the horn tweeter response fluctuated in a series of jumps with nulls almost every kilohertz. The reason for this is not readily apparent, but seems to be an artefact of the measurement technique as nothing was subsequently noted during subjective testing.

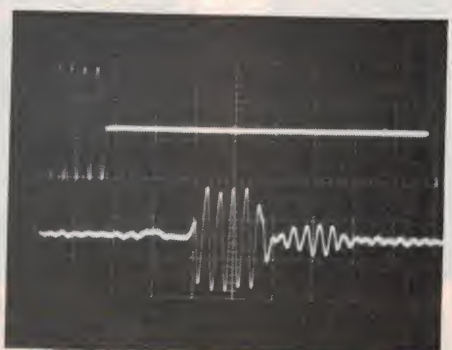
Over the last five years, there has been renewed interest in providing a smooth phase response, or what most designers call "a minimum phase characteristic", for a multi-speaker system. Some manufacturers, notably Acoustic Research, have achieved excellent phase responses by the simple approach of minimising the number of transducers, thereby automatically assisting the complex problem of minimising phase variations. The most notable work in the subject recently has been in the United Kingdom, America and Japan where various researchers have found that positioning of the tweeter with respect to the woofer is of extreme importance.

The best speakers now available position the tweeter, and particularly horn tweeters, behind the low frequency driver, in order to correct for this phase difference and to provide the best minimum phase response. The Altec Lansing 15 achieves this result by placing the horn driver inside the cabinet and following it by an elongated horn so that the phase relationship between it and 300mm driver are as close to optimum as could be desired.

The phase response is very smooth indicating that the designers have achieved the right combination. The difference between "on" axis and "off" axis is remarkably flat and a credit to the dispersion angle of the horn tweeter. The adjustment of the medium frequency and high frequency controls to maximum and minimum does boost the performance, as indicated by the



Tone burst response at 1 kHz (90 dB at 2m).



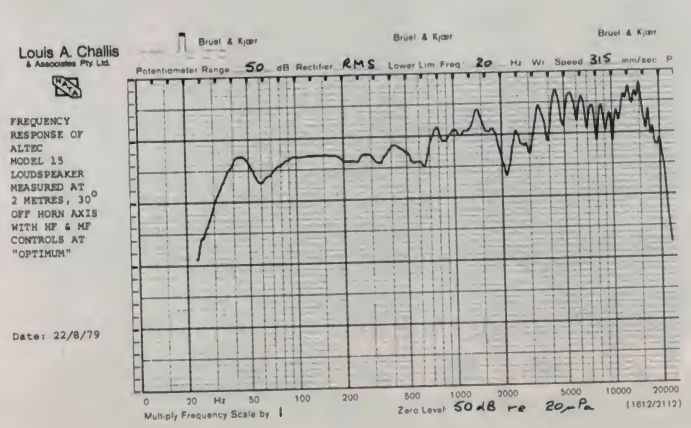
Tone burst response at 6.3 kHz(90 dB at 2m).

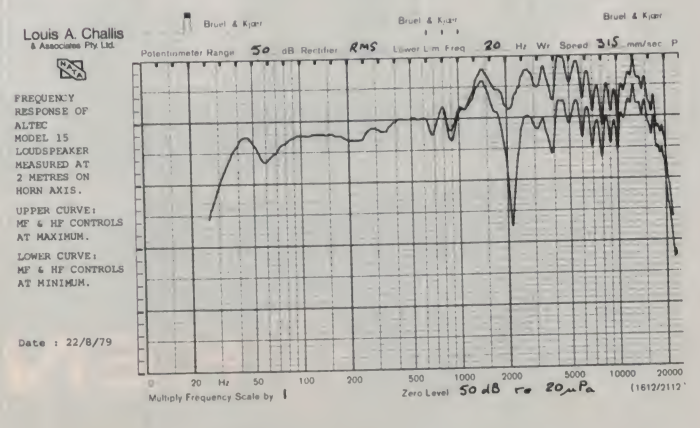
manufacturer, but at minimum mid-range frequency positions a significant notch is created. This occurs adjacent to the crossover frequency between the low frequency driver and the horn tweeter.

The impedance curve indicates that the speaker would provide good loading conditions for any amplifier with the lowest impedance being 9.5 ohms, the highest being 38 ohms at the 50 Hz reasonance.

We measured the total radiated power of the speaker with a 12-point hemispherical array under anechoic conditions with 1 watt of pink noise fed to the input of the speaker. Under these conditions the acoustical output was ±6dB from 31.5 Hz to 20 kHz. With an input of 2.2 watts the output level was 90 dB at two metres. At this drive level, the distortion characteristics of the speaker are commendably low with total harmonic distortions of 1.9%

(continued page 130.) ▶





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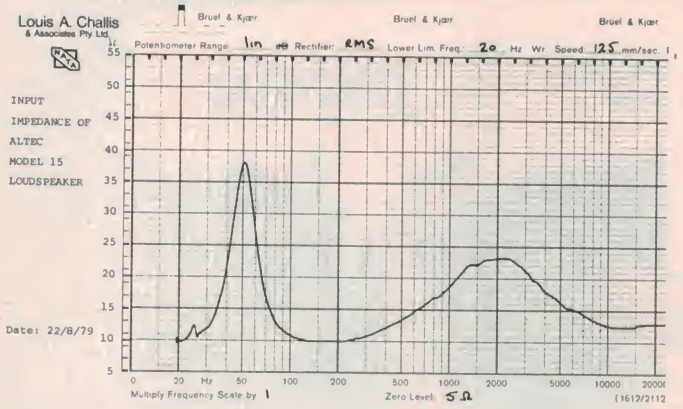
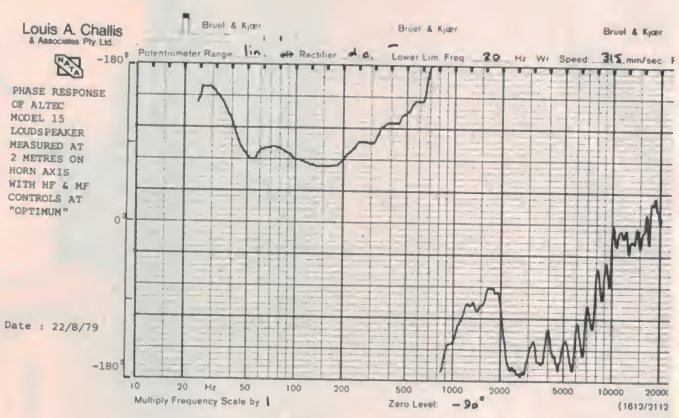




at 100 Hz, 0.8% at 1 kHz and 1.2% at 6.3 kHz. It is only at frequencies below 50 Hz where the distortion does become significant and then only at output levels in excess of 94 dB.

We subjected the speaker to a series of tone burst tests and the transient performance of both the low frequency driver and the horn tweeter showed a commendable lack of ringing.

Subjectively

On good programme content the Model 15 is clean and remarkably free of colouration. With the speaker positioned in front of a wall, the low frequency boost due to reflections around 60 Hz re-balances the performance and provides a commendable bass response. The treble response is remarkably clean and quite transparent.

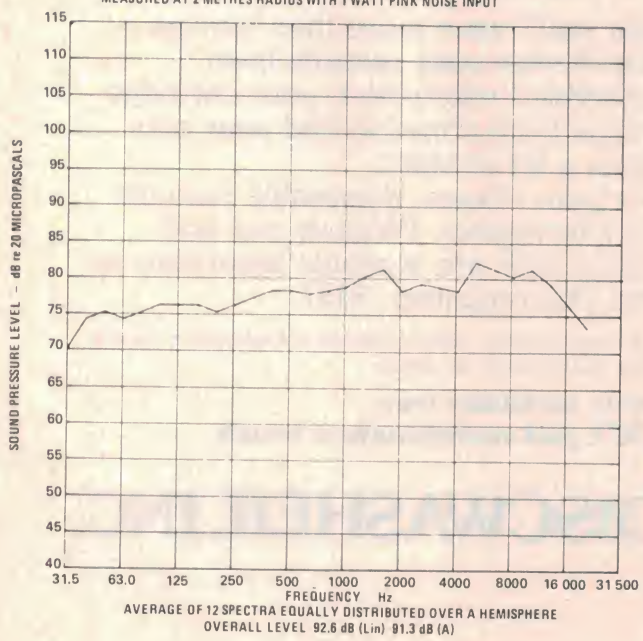
A monitor speaker is one which, by definition, provides a wide frequency response, low distortion and lack of colouration. The Model 15 has all these attributes and adds to them an impeccable phase response and unusually good transient performance.

Considering the price tag of $1600 a pair, this system must rate very highly for monitor purposes in any studio and just as well for those well-heeled, fastidious amateurs seeking a system with that "edge in performance" over the garden variety systems they may already have. ●

THE ALTEC MODEL 15 STUDIO MONITOR LOUDSPEAKER

Dimensions: 686mm high x 559mm wide x 387mm deep
Weight: 34.5kg Price: $1600 per pair.
Manufactured by Altec Lansing International, California U.S.A.
Available through Rank Industries, 12 Barcoo St., East Roseville 2069.

NOISE ANALYSIS CHART



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MEASURED PERFORMANCE OF

ALTEC MODEL 15 STUDIO MONITOR LOUDSPEAKER

FREQUENCY RESPONSE: 35Hz to 20kHz ±6dB (on axis)
35Hz to 20kHz ±6dB (30° off axis)

CROSSOVER FREQUENCY: 1700Hz

TOTAL RADIATED POWER RESPONSE: 80Hz to 16kHz ±3dB
(average power radiated through a hemisphere) (see graph)

SENSITIVITY:
(for 90dB at 2m, 1kHz) 4.2V rms = 2.2 Watts (nominal)

HARMONIC DISTORTION:

	100Hz	1kHz	6.3kHz
2nd	-35.3dB	-43.6dB	-38.3dB
3rd	-46.5dB	-48.5dB	-60.4dB
4th	-44.1dB	-54.0dB	-75.5dB
5th	-54.0dB	-63.1dB	-
THD	*1.9%*	*0.8%*	*1.2%*

INPUT IMPEDANCE:

100Hz	11.0Ω	
1kHz	18.5Ω	
6.3kHz	15.0Ω	
Minimum	9.5Ω	(20Hz)

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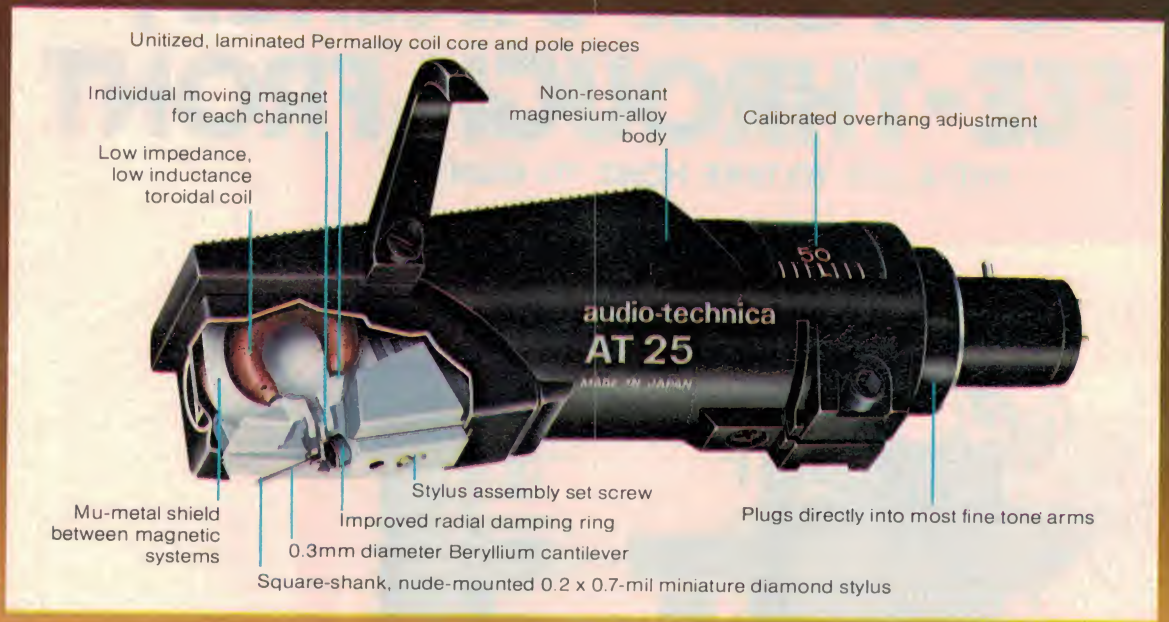

Bold, creative new technology sets new standards for clarity, dynamic range, and stereo separation.

Of course the new AT25 doesn't look like other stereo phono cartridges. It's entirely different. And not just on the outside. We've rethought every detail of design and construction. All in the interest of the smoothest, cleanest sound you've ever heard. The AT25 frequency response is utterly uniform. Definition and stereo separation are remarkable. Dynamic range is awesome. Even the most demanding digital and direct-to-disc records are more spectacular, more musically revealing.

But set our claims aside and listen. The AT25 is unexcelled for transparency and clean, effortless transient response. Individual instruments are heard crisply, without stridency even at extremely high levels. Even surface noise is less apparent.

The cutaway view shows you how we do it. Start with the coils. Just two, hand-wound in a toroidal (doughnut) shape. A unique shape which cuts losses, reduces inductance, and lowers impedance. The coils are wound on laminated one-piece cores which also serve as pole pieces. Again, losses are lower. Eddy current effect is also reduced. Which all adds up to superior transient response. It's like having the electrical performance of the finest moving coil designs, but with the high output of a moving magnet. The best of both worlds!

Each magnetic system is completely independent. No common circuits. We even add a mu-metal shield between the coils to insure no leakage between channels. Which results in stereo separation which must be heard to be believed.

But there's more. An entirely new stylus assembly with one of the smallest whole diamond styli in series production. Only 0.09mm in cross section and almost invisible. It's nude-mounted and square-shank to insure exact alignment with the groove. And it's set in a Beryllium cantilever that eliminates flexing.

Instead of snapping into place, this stylus assembly is held rigidly to a precisely machined surface with a small set screw. A small detail which insures perfect alignment, no spurious resonances, and simple stylus replacement.

We treat cartridge shell resonances too, with special damping material applied to the top of the unique plug-in shell. The magnesium shell even has a calibrated adjustment for stylus overhang to insure perfect installation.

The many technical differences between the new AT25 and every other stereo cartridge are fascinating . . . and significant. But the real difference is in the resulting sound. It's almost as if you had plugged your stereo system directly into the studio console. Every subtlety of artistic expression is intact, no matter how complex—or simple—the music, no matter how loud—or soft—the performance. It's as though a subtle barrier had been removed adding clarity and presence to every record you own.

A cartridge of this sophistication and high quality cannot be produced quickly. Initially the AT25 may be in short supply. But your patience will be rewarded with performance which will send you back through your record library to discover nuances you never suspected to hear. And you'll eagerly await the sonic splendors of tomorrow's digital recording techniques.

This outstanding performance is now available two ways: the direct plug-in AT25 and the standard-mount AT24. Either one will make every other component you own sound better, including your records!

Model AT25 Unitized Headshell/Dual Magnet™ Stereo Phono Cartridge

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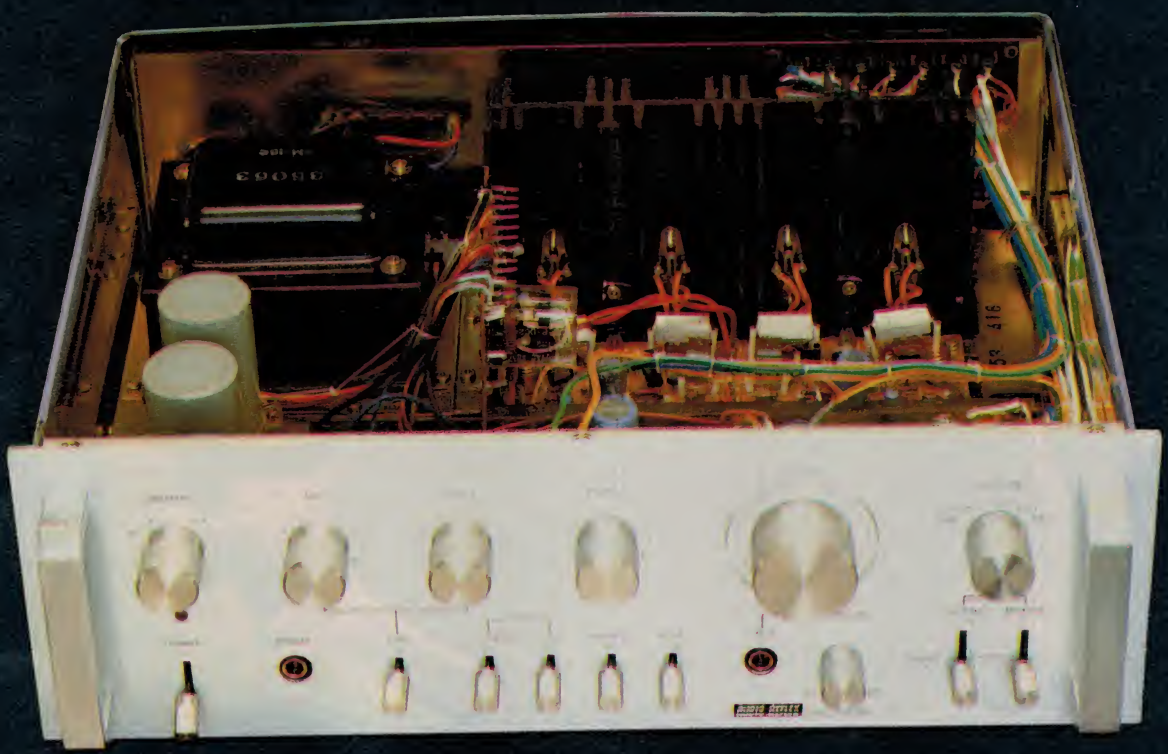

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T79.27

Video cassette recorders — here to stay, or gone tomorrow?

Les Bell

There are now a number of systems around, no common standard, and the shifting ground of technological development poses both technical and marketing problems.

VIDEO CASSETTE RECORDERS (VCRs) are no longer regarded as toys or gadgets for the rich — people can see that they have important and convenient uses — and most importantly, they have recently dropped in price considerably!

VCRs really do have the advantages listed in the advertisements; you can record one programme while watching another, record programmes while you're not at home etc. In spite of these advantages and selling points, sales of VCRs in Australia have been disappointing. The result has been heavy discounting.

Bearing in mind the largely mechanical nature of the machines however, they [illegible] drop any further in price. Consequently, this is a good time to buy a VCR — or is it, with video disks, holographic recording and other developments now emerging from the labs? This article attempts to unravel some of these questions and examine both current and upcoming technology. *— continued page 139.* ▶

SONY

KV 2000AS

First Trinitron, now Betamax. Sony gives you one great innovation after another.

SL-8000AS

First Sony took state-of-the-art television technology to a new high with the Trinitron color TV.

Now Sony technology takes the enjoyment of viewing television to new heights with the Betamax videorecorder.

Connect Betamax to your TV and you can record anything. You capture the best shows on television and play them back to view again whenever you like. Whenever it best suits your schedule.

But that's only the beginning of what Betamax can do.

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It took twenty years of technological experience to make a videorecorder that will do all this and still be compact enough for the home.

Sony experience also made the difference in the Betamax videocassette. It's easy to store and handle because it's the smallest cassette on the market, yet it holds more than three hours of continuous programming.

And there's the Betamax U-loading system. Experience has proved it to be the most reliable, most stable tape transport system for videorecording. It delivers a picture that is picture perfect.

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Sony Betamax

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After intensive research and development, Accuphase proudly announce the release of the most advanced amplifier ever to be released in Australia — the new E303 Power MOSFET Integrated Amplifier.

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The Accuphase E303 produces a very conservative 130 watts RMS/channel with less than 0.02% distortion and is designed for optimum perform ance with any loudspeaker load. Its quality and design are, of course, in keeping with the Accuphase "Grand Prix" award winning tradition.

The advanced specification of the E303 includes a Head-Amplifier with impedance matching facilities so that any moving coil cartridge can be used directly without the need for noisy external transformers or head amps. There is also a versatile tone adjustment system with variable loudness and turnover points.

For the technically inclined, some of the advantages of Accuphase's Power MOSFET are:

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- Less distortion in the extreme high and low frequencies due to an increased power band width.
- Instant switch on efficiency peak. Normal amplifiers take up to fifteen minutes to reach their peak efficiency.

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Now you can hold the power of a computer in the palm of your hand. Power that can dramatically increase your productivity. Provide the answers you need for rapid, accurate decision making. For exploring hypothetical "what if" situations. It's part of what the new era of "Personal Electronics" is all about.

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Take advantage of the versatility of the new TI Programmable 58C and new software. Twelve optional *Solid State Software*™ libraries are now available. Each plug-in library module contains dozens of prewritten programs. Solid-state libraries are available in a variety of fields including engineering, science, statistics, and business. From $36*

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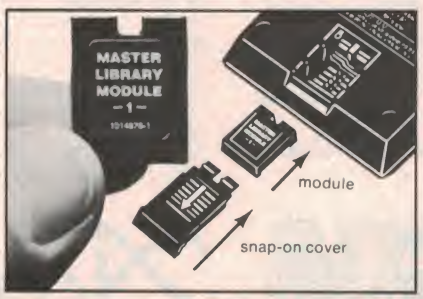

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At present, there are three major VCR recording schemes – the Philips VCR-LP format, the JVC-backed VHS format, and the Beta format originally designed by Sony. All are basically similar, but differ in the mechanical details of the cassettes as well as the organisation of the tracks on the tape, relative head and tape motion, etc.

In both the Beta and VHS formats, adjacent tracks actually touch, with no guard band between them. To avoid interference, the tracks are recorded with opposite azimuths, to correspond to the orientation of the respective heads. Thus, a track recorded by head A produces no output from head B, as the N-S pole is aligned in the wrong direction. Due to the ±6° azimuth, there is no need for guard bands. This allows much denser recording, and consequently longer recording times.

Playing times vary considerably from system to system, as well as depending upon the cassette type. Basically, the VHS format has a maximum recording time of three hours, Betamax 3¼ hours, and the Philips format three hours. The longest recording time, however, is given by the Grundig SVR system, an offshoot of the Philips scheme, which can record up to five hours.

Software

The availability of software, i.e: pre-recorded programmes, is not a major influence in selecting a video cassette recorder. The Video Classics list of films, for example, is available in all the three major formats. Most pre-recorded cassettes are R-rated! (e.g: 'The Case of the Smiling Stiffs', 'Fantasm Comes Again'), but there are some M- and G-rated films (e.g: 'Mysteries from Beyond Earth', 'Magical Mystery Tour', 'Superman').

However, most people don't buy many pre-recorded cassettes preferring to record TV programmes off-air. This raises the question of copyright. Although a test case is currently in the US courts between Walt Disney and Sony (and an unfortunate Sony VCR owner), it is unlikely that an individual in Australia would be prosecuted for taping a TV programme for purely private screenings. Of course, if one was to charge admission, or otherwise contravene the spirit of this 'tolerance' on the part of TV stations and other copyright holders, a prosecution could result.

Of course, by making your own films, you certainly don't violate copyright, and many VCRs have provision for a plug-in camera attachment. Some models have a choice of colour and black and white cameras, so where colour is not important, the cheaper B/W camera will save you quite a bit of money. Not many people buy the cameras, though – we checked with Video Technics in Sydney who estimated one in 200 VCR owners bought cameras. The availability or otherwise of a camera is unlikely to influence a VCR buying decision.

To buy, or not to buy . . .

With department and discount stores offering video cassette recorders at what must be the lowest prices ever, many people are thinking very hard about buying one. The question is, are prices going to drop any further? And if they do, can one be sure that a machine won't be superseded by a more advanced type or by a video disk unit?

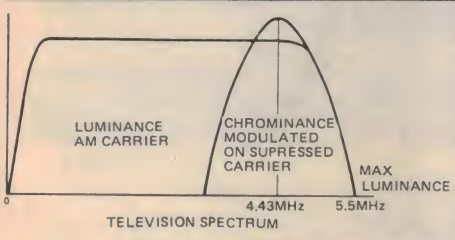
It seems that now is the time to buy. At present, Australian sales of video-cassette recorders are just over half what the companies estimated, consequently there are a large number of unsold VCRs around the country.

In order to get them off the shelves and into people's homes, prices have been discounted drastically. It is unlikely prices will fall much further though, because of the essentially mechanical nature of the beast, which determines the basic manufacturing cost.

There don't seem to be any gigantic breakthroughs just around the corner, threatening to revolutionise the VCR industry. True, there are two new formats awaiting entry from BASF and Philips/Grundig, but these do not offer any striking innovations – not from the consumer's point of view, at least.

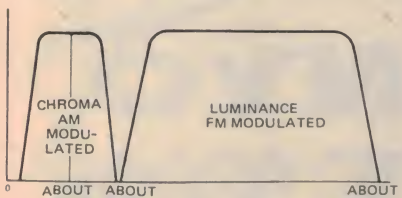
The new BASF machine is unusual in that it does not use a rotating head technique to improve bandwidth. Instead, its Longitudinal Video Recording (LVR) unit uses a single fixed head which records 72 tracks on an 8 mm wide tape, at a tape speed of 4 m/s. By reversing the tape operation every 2½ minutes (which takes 100 ms to accomplish), the 600 m chromium dioxide tape allows three hours of recording.

The combined efforts of Philips ▶



TELEVISION SPECTRUM

As the characteristics of the tape impose limitations on the bandwidth of the signal being recorded, the spectrum of the original television signal is considerably rearranged in the process of putting it on tape. The original signal spectrum, as above, is changed to that in the diagram below. The luminance signal is shifted upwards, frequency modulated onto a carrier, the chroma signal being amplitude modulated on a 700 kHz carrier.



RECORDED SPECTRUM

PUTTING A TV SIGNAL ON TAPE

A video cassette recorder handles signals in a slightly different way from the video stages of a television. A composite video signal, as it appears in the video stages of a TV receiver, consists of two components: a luminance signal, which corresponds to the black and white picture, and chrominance, which is the colour information. Normally, the luminance is a straightforward amplitude modulated signal, while in the PAL system, the chrominance consists of a pair of AM sidebands of the 4.43 MHz chrominance subcarrier.

Since the picture detail is all in the luminance signal, the chrominance can be limited to 1.5 MHz bandwidth while still yielding acceptable picture quality. But the 5 MHz upper limit of the chrominance signal is still too high to be recorded on a VCR, which has an upper limit of around 3 MHz.

To get around this limitation, the chrominance signal is down-converted to around 627 kHz (in the VHS system), so that it can be directly recorded on the tape. The luminance signal is then recorded as an FM signal. In the VHS system, for example, the lowest level of the video signal, the sync tip, sets the FM carrier to 3.8 MHz, while peak white corresponds to 4.8 MHz. Allowing for the sidebands the luminance signal extends from approximately 2 MHz to somewhat above 5 MHz, which is roughly the limit for head operation.

This means that during recording, some fine detail is lost, but on replay, the signal is given some high frequency boost, which helps to sharpen up edges in the picture.

Because the luminance signal is recorded in FM, it is insensitive to variations in recording level, unless it drops out altogether. In this case, special circuitry inserts the previous television line, so that the drop-out is not noticed on the screen.

The audio signal is recorded conventionally, using a single head for recording and playback.

Get the whole movie.
The Full game. The week's news.
3-1/4 hours on one compact cassette tape.
With no breaks.

High Picture and Sound Quality
With easy-on-the-tape rotary loading system and extra-large cylinder.

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Easy recording means you can see exactly what you want. When you want. In beautiful Sanyo "Betacord" color.

Compact Video Cassette Tapes
Super-compact and economical cassettes in 65-, 130- and 195-min. lengths.

SANYO

BETACORD VTC 9300P

This machine can be used with any video cassette tape bearing the mark B

SA-56

Philips' current model, the N1700, priced at $599 – but only until the end of the year – is one of the least expensive machines around.

Sanyo claim their VTC 9300 is one of the best-selling VCRs in Australia today. Using the Beta format, it can play for up to 3¼ hours.

and Grundig have produced the Video-2000 system. Unlike their previous formats, which use a common spool, the cassettes for the new system have two reels of half-inch tape. Unlike all previous cassette formats, these tapes are reversible – that is, they can be turned over in the same way as an audio cassette.

This means that the video head only covers half the tape, with audio recorded at the lower edge and control signals at the middle.

In order to extend replay time, the tape speed is quite low, only 24.4 mm/s. This allows a maximum replay time of four hours per side giving eight hours per cassette. This also means that the track width is quite narrow, only 22.6 μm horizontally. Because of the half width tape, vertical head positioning is also critical, and the new Philips recorder uses some intriguingly ingenious technology to control this.

The video heads are mounted on a piece of piezo-electric material, and by varying the voltage applied to the material it will deform, adjusting the height of the heads.

The VCR automatically records test signals, in order to set up the head alignment, during the vertical blanking interval. In the Philips VR2020, a 223 kHz test signal is recorded for 96 μs, then the machine switches to playback searching for the test signal ▶

PRINCIPLES, IN BRIEF

Video recording is similar in principle to audio tape recording, with one major difference – the enormous information content of a video signal requires a wide bandwidth; approximately 5 MHz to 6 MHz. That is, around 300 times greater than the 20 kHz for hi-fi audio.

In order to record such high frequencies the tape has to move at very high speed past a head with a very small gap – both difficult requirements to meet, at least economically, as the system devours tape.

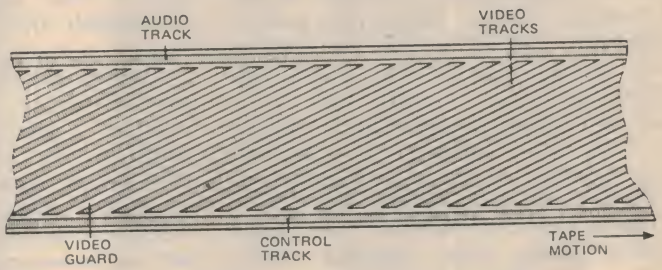
Nonetheless, the earliest video recorders used this technique. In fact, the BBC developed a machine which ran at a speed of 5 m/s (200 in/s), but it was quickly superseded by a technique developed by Ampex. This method of recording, using, rotary heads, has now become the standard for all video recorders.

The problem was to increase the speed of the tape past the head – but bear in mind that all motion is relative, so why not move the head past the tape? This is just what video recorders do, using a helical scan technique.

The principle is simple. The recording head assembly is cylindrical, and rotates at high speed, at a slight angle to the direction of tape motion. As the tape moves past the head a number of long tracks will be impressed at an angle across the tape.

This gives the required head-to-tape speed without moving the tape at high velocities. This is important, because it allows longer playing times for a given length of tape than would otherwise be possible.

Audio is recorded as a separate track at the top of the tape, while the bottom edge carries a control track used to operate the synchronizing and servo circuits on playback, to make sure that the video head covers the same track as it recorded. On many recorders, a tracking control allows the



positioning of the head to be adjusted slightly to account for slight variation between machines.

In practice, professional video recorders have four heads mounted in the head assembly, while domestic machines have two. The two heads record alternate video tracks.

The cassette tape format was designed to get around threading problems on 'open-reel' types. When a cassette is inserted into any of the popular VCRs, the machine removes the tape from the package and wraps it half way around the head. The tape also passes over a rather more conventional head which records the audio and control tracks, as well as a separate erase head.

Both the Philips VCR and Betamax formats draw the tape out and around the head with a circular motion, while the JVC-developed VHS format uses a simpler scheme in which two parallel guides draw the tape out and against the head. Because of the accuracy of alignment required, coupled with the complexity of the threading scheme, mechanical interlocks, etc., not to mention the various motors, VCRs are extremely complex mechanically. In fact, the mechanical assembly is the major cost component of the machine, and for this reason, prices are unlikely to drop below their present (heavily discounted) levels. ▶

recorded by the other head. If it can 'hear' that signal, then the tape is out of alignment, and the heads are adjusted appropriately. Note that this system can adjust the height of each head independently, which is not possible with mechanical alignment schemes – and it is self-correcting, too.

If both heads are found to be slightly high or slightly low, then the tape is moved up or down instead of adjusting the heads. This replaces the tracking control on other cassette machines, allowing replay of cassettes recorded on other machines without the need for manual adjustment of tracking.

In order to take advantage of the four hour continuous recording time of the VR2020, it has a 16 day timer, which is, of course, microprocessor based as is the head adjustment circuitry.

At the time of writing, the VR2020 is not yet available in Britain and it is likely to be some time before it appears in Australia.

Video disk machines, like this Philips unit being demonstrated here, offer big recording capacity and many more features than VCRs, but are unlikely to be generally available for several years.

Video disks

Several companies, both in the US and Japan, have been promising video disks for several years now, but so far they've all been fizzers. The only consumer video disk player on the market (in the US) is the Magnavox, which is the result of a collaboration between North American Philips, Magnavox' parent company, and MCA Inc. The system uses a laser both to make the master recording and in the replay unit itself, and uses software marketed by MCA.

MCA itself markets an industrial player, made to its specifications by Universal Pioneer Corporation in Japan.

RCA have for some time now been talking about their proposed video disk, but this has had several setbacks and is now scheduled for introduction in the first quarter of 1980. It is planned to have a price tag of less than US$400, while the Magnavision unit is priced at $775 (and even then it is sold at a loss, if our sources are correct).

However, it is doubtful if video disks to meet Australian standards will be available for the next two years at least.

Perhaps the most significant recent advance in video recorders is the formation of a joint venture company by MCA Inc, in conjunction with IBM. IBM already owns two patents related to optical video disks, and has also turned an unspecified amount of cash over to the venture.

The new company, DiscoVision Associates, has no plans at present to produce a consumer disk machine, and it is easy to see why, considering the current state of the technology. And of course, IBM is quite probably more interested in the possibilties of video disks as data storage devices for computers.

Bearing all this in mind, then, it seems that video disk technology is not yet ready to bear fruit, in Australia at least. At the same time, the next generation of video cassettes will continue to be available for years to come. The current models do most, if not all, that is required from such a machine – and remember, these prices won't last. It's a buyer's market – for the time being.●

This Sony SL8000E 'Betamax' uses the Beta format.

STOP PRESS

A US federal judge has handed down a ruling in the Walt Disney/Sony copyright court case – and Sony have won.

The ruling means that in the US, the commercial use of home video cassette recorders to record television programs does not violate copyright laws.

The suit was filed by MCA Inc., the parent company of Walt Disney Productions and Universal Studios, claiming that the use of home VCRs unfairly reduced the value of the companies' movies.

Note that this ruling applies to the US only, though it is possible that other countries may take the result into account while framing updates in their own copyright laws.

THE "GRAMOPHONE" TESTS CELESTION'S NEW DITTON 551

Celestion Ditton 551 Loudspeaker

Manufacturer: Rola Celestion Ltd., Ditton Works, Foxhall Road. Ipswich, Suffolk, IP3 8JP.

My first introduction to Celestion loudspeakers was around 1925 when they were demonstrated daily in the Peto-Scott showroom in High Holborn. At that time the moving-coil loudspeaker was unknown to the public, although an experimental model was described in the *Wireless World* in August 1926, and later that year BTH

Ditton 551 with grille removed

showed the first commercial moving-coil unit at the Olympia exhibition. The Celestion loudspeaker was one of the first to be mounted in a cabinet and used a large free edge diaphragm. This was made from a very thin parchment-like material, stiffened with a spiral and driven by a large balanced armature, compound magnet system. The *Wireless World* described it as "a really good loudspeaker, the quality is distinctly good although the tone may be slightly on the loud side" — whatever that may mean! From those early days Celestion loudspeakers have maintained a high standard and, except for one excursion into the electronic field with the Celestion Telefi pickup unit which enabled one to take a signal from a television receiver and apply it to a better quality amplifier and loudspeaker, Celestion have always concentrated on manufacturing loudspeaker units and enclosures.

The cabinet of the Ditton 551 is constructed from 18mm thick dense particle board, finely veneered with American oiled walnut on both sides and all inner surfaces are covered with thick acoustic absorbing material. The front baffle is recessed so that the three drive units and the twin constant-impedance attentuator panel is flush with the baffle. The baffle also carries a plastic vent to improve the bass response. Recessed into the rear panel is a board carrying two terminals for 4mm plugs. A substantial 22mm thick wood frame supports a newly developed grille material, with six offset plastic studs to hold it against the front panel.

The mid-range and treble units are mounted asymmetrically in relation to the centre line and bass unit. When used in pairs for stereo reproduction, the speakers should normally be positioned with the mid-range and treble units innermost, to obtain the smoothest frequency response and directional characteristics.

The newly developed bass unit consists of a massive 290mm diecast aluminium chassis carrying a 2.9kg barium ferrite magnet. The diaphragm is made from a fibrous material with a lossy mass at the junction with the voice coil and a PVC roll surround terminates the diaphragm edge. The voice coil is 50mm in diameter and supported on a glass fibre laminated former which is able to withstand high temperatures. Free air resonance was measured at 45Hz but, when mounted in the reflex vented cabinet, the −3dB point falls to 38Hz.

The MD701 mid-range unit also uses a massive 2.7kg barium ferrite magnet mounted in a diecast aluminium mounting plate. A 46mm diameter voice coil drives a PVC impregnated cellulose fibre woven soft dome diaphragm. To protect the diaphragm, a dished 135mm diameter open weave gauze cover is fitted. The HF2001 treble unit has a barium ferrite magnet weighing 0.65kg. A 19mm polyamide impregnated voice coil drives a hot pressed polyethylene terephthalate polymer diaphragm which is also protected with a black metal grille.

The 15-element dividing network makes use of reversible electrolytic capacitors, air and ferrite cored inductors. The mid-range and treble units have 3rd order Butterworth filters followed by constant impedance variable attenuators. Mounted on the attentuator plate is a fuse to protect the treble unit and, if this fails, a LED indicator is illuminated and continues flashing until the fuse is replaced. Both attenuators are capable of giving 2dB boost or up to 6dB cut and also include a compensating network which maintains an 8-ohm resistive load, thereby smoothing the impedance curve.

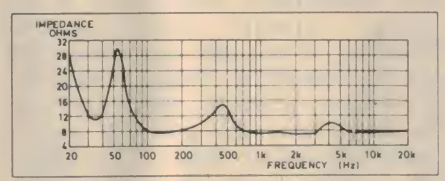


Fig. 1 — Impedance with frequency

SPECIFICATION AND TEST RESULTS
CELESTION DITTON 551 LOUDSPEAKER

	Maker's Specification	Test Result	Reviewer's Comments
1. Type	Three-way reflex	–	–
2. Drive unit diameters(mm)	290, 50, 19	–	–
3. Frequency response (Hz)	38 – 20,000 ± 3dB	Agreed	–
4. Crossover frequencies (Hz)	600 and 4,500	Agreed	Sensible choices, well within the range of each unit
5. Nominal impedance (Ω)	8	See Fig. 1	Does not fall below 7 ohms
6. Power handling capacity	140 watts (music) 22 volts bass 14 volts mid-range 11 volts treble	Agreed	Will cope with amplifiers rated 20 – 140 watts
7. Distortion	2nd and 3rd harmonic 2% at 20Hz. Less than 1% above 100Hz	–	No audible distortion at high domestic volumes
8. Sensitivity	3.25 watts peak noise for 90dB SPL at 1 metre in Anechoic room	3.1 watts in open air	–
9. Dimensions (mm)	720 x 395 x 328	= 28½ x 15½ x 13"	–
10. Finish	Oiled USA walnut elm or black ash	–	–
11. Special features	Mid-range and treble level controls	–	–

M&G/a3

Speaker Positioning

Nearly all loudspeaker manufacturers offer suggestions as to the positioning of their loudspeakers in the listening environment. Usually they suggest that the distance between the speakers for stereo should be around 3 metres, but they seldom offer information as to the effect of placing the speakers near the room boundaries. Celestion engineers have measured the effect of placing the loudspeakers in three posssible positions and their response curves are shown in the user's leaflet. They market a neat square-section steel stand that raises the loudspeaker some 250mm (10 inches) above the floor level.

Loudspeaker positioning is further complicated by the effect of the ceiling, shape of the room, and the wall construction. Therefore one should experiment by moving the loudspeakers around until one finds an acceptable and smooth performance. The Ditton 551 is designed so that when mounted on the Celestion stand, with the centre of the bass unit further than 400mm from any wall, the bass response will be optimum.

Figure 1 shows that impedance never falls below 7 ohms, making the loudspeaker suitable for any modern amplifier. As the attenuators in the treble and mid-range unit filter circuits are followed by impedance compensators, the overall impedance is not changed when one varies the mid-range and treble controls. The power handling capacity of the Celestion 551 is far greater than one would require for normal domestic purposes and, for the past few months, they have been used with a Luxman L-100 amplifier capable of delivering a maximum power output of 110 watts per channel. Using a peak reading meter, I found that even with highly modulated records the power delivered to the speakers seldom exceeded 30 watts for loud domestic listening. The overall frequency response is substantially flat from 40Hz to 20kHz, with the mid-range and treble controls set to the flat position.

Listening to many FM transmissions I found that in my lounge the best position for the mid-range control was flat, whilst I preferred advancing the treble control to plus 1 or 2 — probably due to slight loss of hearing above 14kHz with my advancing years.

Experiments showed that with the speakers positioned about 3 metres apart, 1.5 metres from the rear wall and 1 metre from the side walls gave the most pleasing results. I was particularly impressed by the accurate stereo imaging. As an experiment, the loudspeakers were reversed in position, that is with the mid-range and tweeter units outwards, and there is no doubt that one loses the directional accuracy. Low frequency response was clean and neutral, its extension downwards dependent on the speaker positioning and the size of the listening room. On male speech there was a slight tendency to plummyness, though on music the bass was clean and had good attack. Mid-range response could be altered over a wide range with the control, and normally gave excellent separation and clarity. Turning the control to the −6dB position lost much of the clarity and definition, whilst at the +2dB position it brought forward the mid-range tones quite noticeably. The extreme top response was notable for excellent transients and smoothness, a legacy from many years of producing high quality tweeter units used in other manufacturers' products and BBC monitoring loudspeakers.

On direct broadcast transmissions, such as the Mozart *Magic Flute* from Covent Garden, one noted the excellent definition and smooth transition from one speaker to the other as the characters moved across the stage, a feature sometimes lacking in less precise loudspeakers.

Summing up, this must be the most musical loudspeaker I have so far heard by Celestion. It is perhaps rather large for some living-rooms, but, if it can be accommodated, it is well worth having a demonstration in one's own home. Impressively finished, whether one leaves the acoustic grille on or not, it should meet all the demands of domestic reproduction. There are two sister designs, the Ditton 442 and Ditton 662 which are also worth investigating.

John Gilbert.

Reprinted from "Gramophone" May, 1979.

RTR DR-1 speaker system

Whilst the DR-1 features extremely good uniformity of dispersion the distortion and efficiency leave much to be desired.

ELECTROSTATIC SPEAKERS attract the interest of most speaker designers and audiophiles because of their ability to produce high quality transient signals at frequencies extending beyond the audible frequency range. Many of the developments in electrostatic speakers have fallen by the wayside because of insidious problems associated with ionisation in wet weather, high frequency hiss and directional patterns which have generally been extremely sharp at higher frequencies.

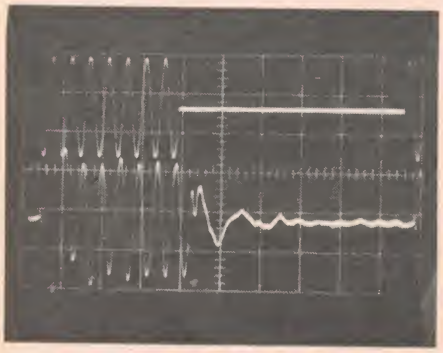
RTR is a medium-sized American manufacturer who specialises in unusual designs for loudspeaker systems. The DR-1 is very much an unusual design for, not only is it bigger and more apparent than most other systems, but the designers have gone to unique lengths to produce an omni-directional polar pattern in the horizontal plane. The appearance of the unit may be regarded as striking although there are very few people who would consider the unit as being able to fit in with their living room decor.

The unit consists of two parts: the lower and larger portion contains the low frequency drivers, together with large power amplifier built in; the top portion consists of the electrostatic tweeter array with a polarised plug and socket system to provide the inter-connection and power drive from the unit immediately below. The lower section contains three speakers consisting of two 250 mm drivers and one 300 mm driver. These are enclosed in a cabinet which is fully veneered on the front face with the dark walnut veneer grooved to emphasise the edges. The two side panels have insets of black cloth on a wooden frame covering, with one 250 mm driver on each side.

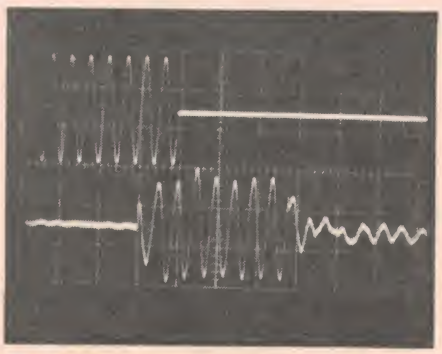
The other driver is somewhere inside but its position is not specified. The back panel is rather surprisingly unveneered particle board with the power amplifier escutcheon panel and protective handles located on the lower face. This is surprising for a speaker designed for 360° radiation. This panel contains a coaxial input along with treble and volume controls for the electrostatic unit. At the base of the panel there are a pair of universal terminals for the woofer and a re-set table relay to protect the low frequency driver section.

The electrostatic tweeter in the upper section is very unusual. It consists of a circular cylindrical array of 27 electrostatic diaphragms which maintain the "point source" radiating pattern by automatically decreasing the cylinder height with increasing frequency. By this means the designers apparently intend to maintain the apparent source location without changing the relationship between direct and reflected energy when mounted near a reflective surface. In front of the array, but set behind the cloth, is a blue/green pilot light. This changes to yellow if the unit is overloaded.

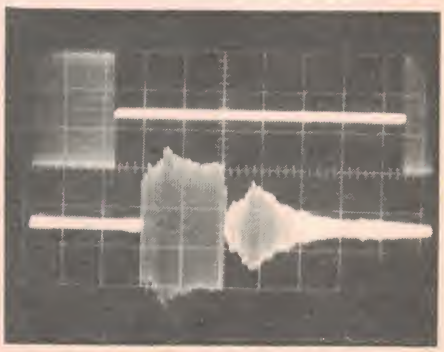
The 13 page booklet that comes with the unit is presented in the form of a speaker system manual. It provides only a little technical data by which the characteristics of the system could be



Tone burst response at 100 Hz (80 dB at 2m).



Tone burst response at 1 kHz (80 dB at 2m).



Tone burst response at 6.3 kHz(80 dB at 2m).

assessed. It includes two small pages on "trouble shooting" and a statement that other fine points and design are beyond the scope of discussion within the manual itself. Where such a discussion is to be found is left to the purchaser's and this reviewer's ingenuity.

Evaluation

The objective testing of the system proved to be interesting. Here for the first time was a rather expensive speaker system for which normal testing could not be carried out at our standard level of 90 dB at 2m because of the level of distortion that resulted. This discouraged us so that, rather than risking damage to the unit, we opted, after trying both units out, to conduct our tests at 80 dB where the level of distortion was quite acceptable and the performance generally equivalent to other speaker systems at a higher drive level.

The most important feature of the DR-1 showed itself to be the omni-directionality of frequency response. The actual response extends beyond the normal limits to over 25 kHz. Even at frequencies as high as 20 kHz the flatness of the response achieved by the system was within 6 dB almost irrespective of the angle from which it was measured. If they achieved nothing else this would undoubtedly be a commendable achievement. Although the response is not absolutely flat there can be no denying that the uniformity of dispersion is extremely good.

We measured this performance at a series of heights and with the controls set to an optimised level response utilising our real time analyser. Whilst it may be possible with good ears to adjust the balance between the external low frequency drive amplifier and the internal electrostatic tweeter amplifier by ear, we found it extremely hard to do on normal programme content. Actually, the best way of doing it is to use either a pink noise generator or to adjust it with a test record featuring octave or third octave filtered bands with a common output level.

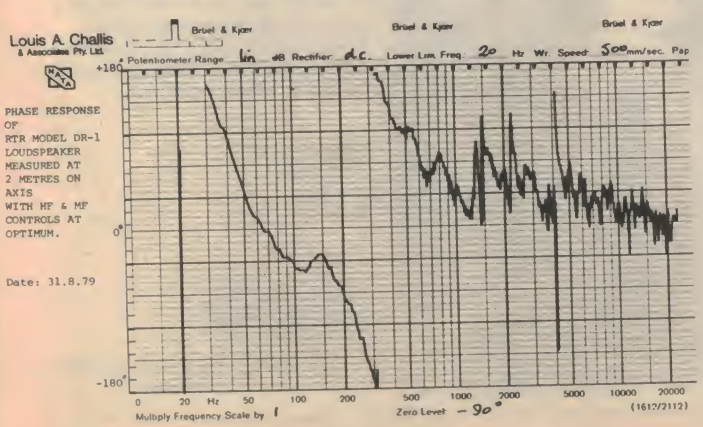
The DR-1 is comprised of an electrostatic omnidirectional tweeter assembly at top, with conventional low frequency drivers (with amps) - two 250 mm units and one 300 mm unit - in the lower section.

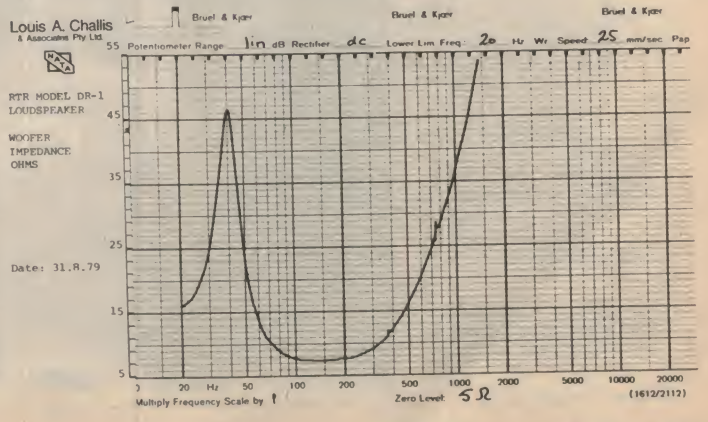
When properly adjusted the balance of the speaker system is reasonably flat although not as flat as some other electrostatic speakers that we have measured and reviewed over the last 10 years. Only the low frequency section is accessible for impedance measurements and, as can be seen from the graph, the lowest impedance is 7.2 ohms and the highest runs off the graph because of the crossover characteristics.

The phase response of the overall system is reasonably good considering the combination and type of speakers and arrays being used, although it would hardly classify as a minimum phase speaker. The distortion characteristics of the speaker leave much to be desired. At both low and high frequencies, above 90 dB at two metres, the distortion is, in our opinion, unacceptable.

The transient performance, measured by tone burst tests, produce poor outputs right across the high frequency spectrum which is not uncommon with electrostatic system. The efficiency of the system is low as it required 18 W to produce 80 dB at two metres under anechoic conditions. This would correspond to approximately 180 W for 90 dB at 2m. Obviously with that sort of power level on transients amplifier output becomes a factor in the distortion characteristics generated.

– to p. 148. ▶





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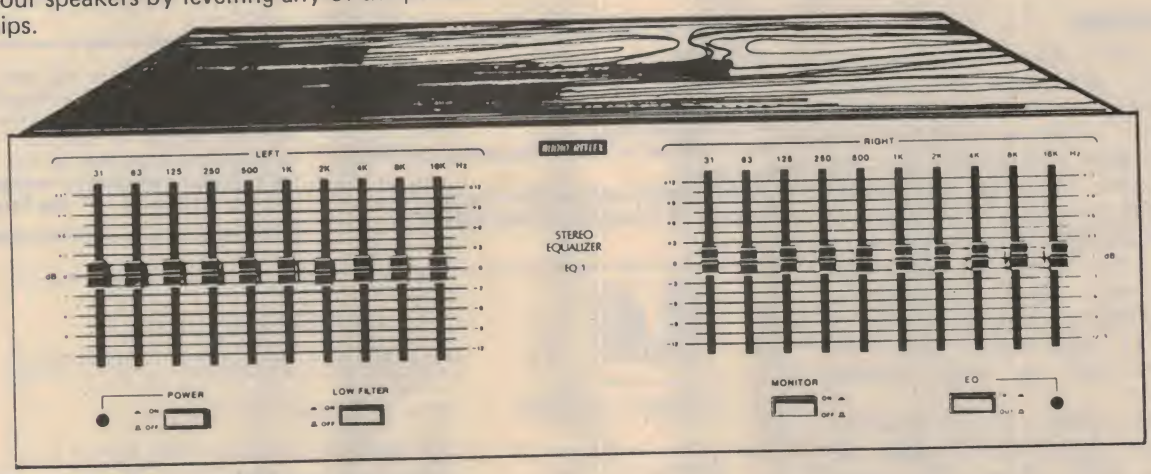

What the critics say .....

HI-FI & MUSIC, May 1979 — "The Audio Reflex equalizer has been carefully designed for general use in systems owned by audiophiles who require that 'something extra' in hi-fi systems."
CANADIAN STEREO GUIDE, Winter 1979 — "Separation between the two channels was excellent, being better than — 64dB across the range. THD was also exceptionally low, as was equipment generated noise."
THE FM GUIDE (Canadian) 1979 — "Quality, that was only hinted at with the original material, can be brought out through proper use of this well-designed, modestly priced, and simple-to-operate frequency equalizer."
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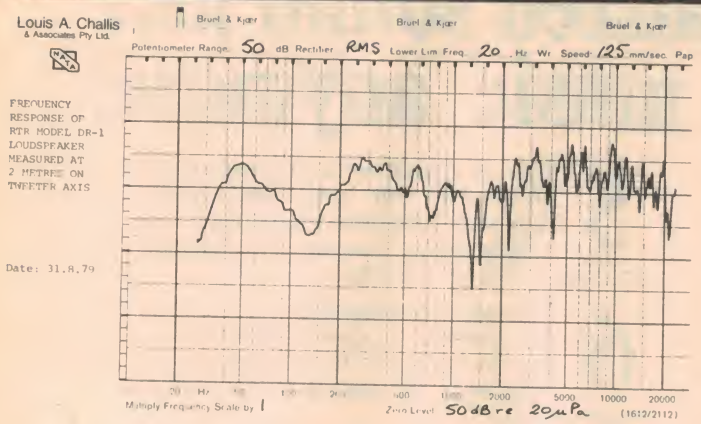

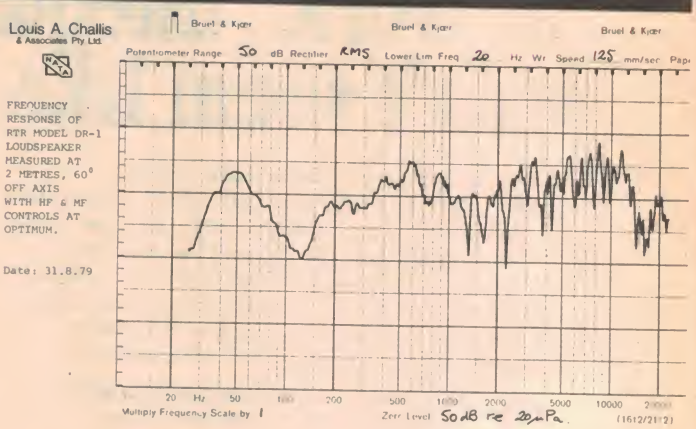

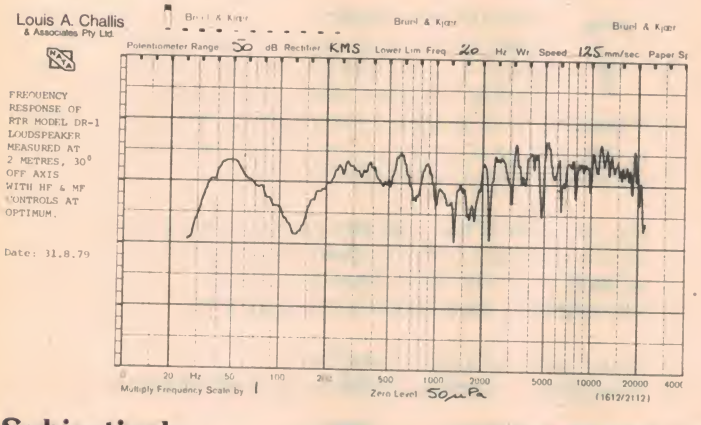

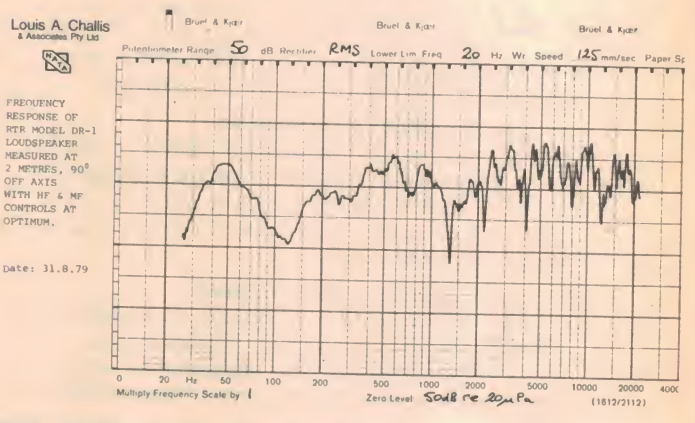

Subjectively

The subjective testing proved to be more enlightening than even the objective testing. Even at levels below 90 dB the performance of the unit was far from the transparent performance that one would expect from an electrostatic speaker. On bass, guitars, singing and even violins, the added degree of colouration was detectable even at low listening levels. The accentuation of high frequencies, typically in the 10 kHz to 16 kHz region, was quite pronounced and on some content disturbing.

The DR-1 speaker system would be suited for background music in restaurants, public places and cocktail parties but lacked the clarity and definition that we would look for in a speaker system costing so much money.

In the DR-1 RTR have produced a loudspeaker with a number of attributes, including omni-directionality and extended frequency response, which some people may desire for their loudspeaker system. Unfortunately, they have added limitations in terms of distortion and colouration which nullify the major attributes of the system. It is not the speaker system that we would recommend for the purist or even the well-heeled audiophile. ●

THE RTR DR-1 LOUDSPEAKER SYSTEM

Dimensions: 1244mm high x 419mm wide x 419mm deep
Weight: 64kg Price:
Manufactured by R.T.R. Industries, California, U.S.A.
Distributed by Acoustic Monitor Co. Pty. Ltd., 12-18 Gould St, Enfield NSW 2136.

Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF

RTR MODEL DR-1 LOUDSPEAKER, SERIAL NUMBER 034878

FREQUENCY RESPONSE: 30Hz to 20kHz ±6dB
(at any angle in horizontal plane)

SENSITIVITY: 100Hz 12V rms (woofer) - 18 Watts nominal
(for 80dB at 2m) 1kHz 320mV (mid range electrostatic amplifier)

HARMONIC DISTORTION:
(for 80dB at 2m)

	100Hz	1kHz	6.3kHz
2nd	-35.9dB	-38.9dB	-44.6dB
3rd	-51.5dB	-52.5dB	-38.3dB
4th	-65.2dB	-57.4dB	-57.3dB
5th	-62.1dB	-58.3dB	-
THD	*1.63%*	*1.17%*	*1.36%*

INPUT IMPEDANCE:
(Woofer)

100Hz	7.5Ω	
1kHz	37.0Ω	
Minimum	7.2Ω	(150Hz)

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Harrassed by hum loops?

When hum bugs your system you can comfort yourself with the thought that even professionals have the same trouble — but that doesn't help you much! However, hum is generally solved quite easily — as long as you know what to look for.

THE MOST COMMON IRRITANT in hi-fi systems of any performance or cost standard is almost certainly hum, that horrible, low pitched noise which strikes almost every system at least once in its life. In fact, the only good thing that can be said about hum is that it is not selective; it will strike both amateur and professional equally.

And the most aggravating thing about hum is the trouble that it may cause — not that it will normally damage components unless extremely bad, but because it may sometimes take hours of concentrated searching to track it down. Until the cause is located and the problem corrected, satisfying listening is impossible.

What is hum?

Once hum has been heard it is unmistakable.

It is also difficult to describe. Typical textbook descriptions run pretty much as follows: 'HUM — an unwanted low-pitched sound produced in reproduction by an interference from the ac mains. It usually occurs at the mains frequency of 50 Hz, or at its second harmonic, 100 Hz. Can be caused by . . .", and then follows a list of about a dozen typical causes.

In spite of the rather open-ended descriptions, hum is immediately recognisable.

Its causes are not so easily pinpointed, although the sources of hum found in hi-fi systems can usually be traced back to any one of three chief sources — loops, screening and induction.

Hum generally affects low level signals with high circuit impedances — so the pickup cartridge and its associated signal connections are the prime offenders. The high gain of this circuit, and the large amount of bass boost applied in the RIAA equalisation, make it exceptionally prone to hum from any of the various causes.

In Australia, the ac mains power supply is a nominal 240 volts, alternating with a frequency of 50 Hz. Wherever these voltages occur, the mains conductors are surrounded by electrostatic and magnetic fields which fluctuate at the same frequency. With a voltage as high as 240 volts, these fields are fairly intense, and can produce hum by inducing tiny ac currents in surrounding wiring and components.

Occasionally hum may arise from a faulty component in some piece of equipment, but most problems come from the linking and positioning of the hi-fi components.

Loops

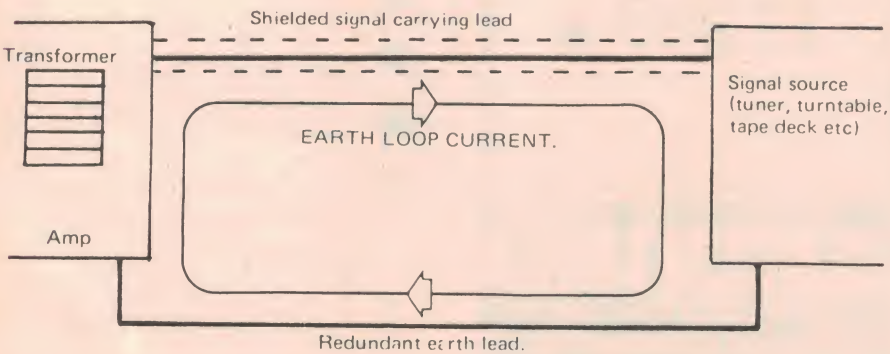
Earth loops are possibly the most common cause of hum, and are the most annoying in that they are frequently caused by taking too much care! They are formed by duplicating earth links between components — a real trap for beginners attempting to set up a foolproof system.

The problem arises when the earthed screen of a signal carrying lead is correctly earthed, but an additional earth link is formed between the two components. The separate earth link may be redundant, in which case it forms an electrical loop.

If there are slight potential differences at the earth points, or if the loop falls within a stray magnetic field, a tiny circulating ac current will start to flow within the loop. This current affects the audio signal carried in the central core of the conductor by adding unwanted components to it, and hum results.

Sometimes the loop may be formed through no fault of the person assembling the system. When the earthy sides of the signal connectors on the amplifier (or other component) are linked internally to form a common ground, a loop is very easily completed.

Troublesome loops are known as 'earth' or 'hum' loops, and although they are the common cause of a great many problems, their source may well be different in each case, and their cure may take considerable time and careful thought.



Earth, or hum, loops are set up when a redundant earthing link is formed between two components. The stray magnetic field around a transformer (in this case in the amplifier) can induce a small current in the loop. This tiny alternating current, flowing in the signal lead's shield is sufficient to produce unwanted components in the audio signal, and this is heard as hum.

The ideal interconnecting system between any two components conveys the signal and the earthy (signal return) conductors for each channel by only one path – via a live and an earthed conductor. Separate earth connections should be used only to earthed metalwork which is not connected to the signal carrying circuits. Because of this pickup arm on a turntable is earthed separately without causing hum loop problems.

In these cases earthing may be essential to draw off any leaked voltages or static build-up directly to the mains earthing point. If these spurious voltages were carried via the signal earth leads, they too could cause interference with the audio signal.

Curing earth loops

As hum loops are set up when there is a redundant earth connection, they can be cured by breaking the loop – that is, by removing the redundant earth.

The process of tracking down a hum loop problem is rather long and laborious. If the majority of connections are made by RCA-phono plugs and sockets, it is rather more simple than when DIN connectors are used.

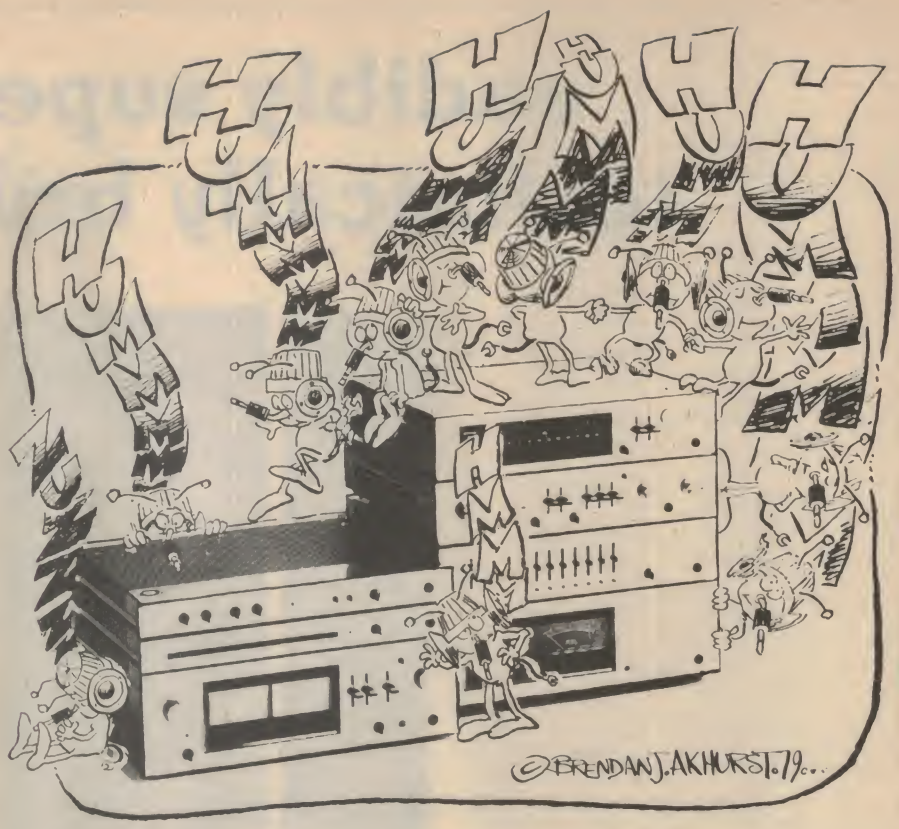
Start by disconnecting all inputs to the amplifier except for the separate earth link between the turntable frame and the amplifier's chassis. Connect one channel of the turntable and note the hum level. Try pulling the plug slightly out of the socket so that the outer rim doesn't still make contact. If the hum is now worse, push the plug fully home – excessive hum indicates that the rim contact is not redundant but is needed for shielding. If, however, the hum is reduced with partial connection, leave the plug as it is – this earth is redundant.

Now check the second channel from the turntable in the same way. If the hum is still present in spite of these checks, try removing the separate earth link from the frame of the turntable to the amp. It is unlikely that this will be redundant, as ideally it should be isolated from the signal carrying components. In rare cases, however, its removal may help.

Continue this checking process in the same way for all inputs, until you are sure which earth links are redundant and may be disconnected permanently.

DIN connectors pose more of a problem, and unless you are sure of your ability with a soldering iron it will be better to check only the auxilliary earth connections, and then investigate to see if the problem lies elsewhere.

When working through the checking procedure, make sure that the amplifier's volume control is turned down whenever making or breaking contacts. High level transients are easily generated, especially when checking for loops in the vicinity of the turntable.



When those hum bugs get your gear, you're really gonna know it !

Electrostatic hum

Because of the fairly intense electrostatic fields surrounding mains supply cables, any signal-carrying leads within such a field may be affected, because of the capacitance across the space between the cables. The higher the circuit impedance, and the lower the audio signal level, the more likely the occurance of hum breakthrough.

This problem is generally overcome by the use of an earthed shield around the signal carrying conductors – hence the almost universal use of shielded leads for connections between components.

The screen must be arranged so that the live conductors are shielded by some earthed metal at all times – it will be seen when looking at RCA or DIN plugs and their appropriate sockets, that this requirement is fulfilled. It is to prevent this type of hum that almost all signal carrying leads between components in a hi-fi system use a shielded cable.

The shield, or braid, should itself be insulated so that it doesn't inadvertantly contact any other earthed metalwork. If this happens, the earth bypass created will form an earth loop to bring even more hum.

The only components which do not require shielded connecting leads for the audio signals are loudspeakers, which are fed by high level signals via a low impedance circuit.

While it may be an advantage to use earthed metal equipment cabinets as a shield against induced electrical hum, this is not possible when the cabinet is electrically connected to the equipment's chassis. In this situation, any separate earthing of the cabinet will form a hum loop – the cure may be worse than the original sympton.

Curing electrostatic hum

The most obvious cure for hum of this sort is prevention. Any signal-carrying lead should be kept well clear of all mains supply cables, and should also be kept as short as practicable. However, as electric fields are coupled by capacitance, and the effects diminish as distance increases, length should not be sacrificed unnecessarily. Never lengthen the connecting cables supplied with a turntable, however, as this will degrade the unit's performance.

Mains cables should consist of

– *continued on page 157.* ▶

audibly superior technically brilliant!

Otoscan 3B

Otoscan 3B has been designed for those who are seeking the ultimate in loudspeakers. Its development has taken 3 years intensive work by some of the most highly qualified people in the industry. No other company in the world has produced a loudspeaker which exhibits the synergy of modern computer-aided research and the very latest innovations which are to be found in Otoscan 3B.

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* Record-end detection employs non-contact system — tonearm velocity is optically detected when it moves from sound groove to lead-out groove
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* Oil-damped, automatic arm lifter
* Adjustable tonearm height
* Cueing and Stand-by switch
* Wow and flutter of 0.018% Wrms (as measured by Denon with magnetic pulse wheel)

SPECIFICATIONS

Model DP-1200

Phono motor

Drive system	Direct drive by AC servo motor
Speed control	Frequency detection servo system
Speed	33 1/3 rpm, 45 rpm
Speed adjustable range	over ±3%
S/N ratio	over 75 dB (DIN-B)
Starting time	less than 1.5 sec (33 1/3 rpm)
Turntable	Aluminum alloy diecast, 30 cm diam.

Tonearm

Type	Static balance type (automatic arm lifter)
Effective length	244 mm
Overhang	14 mm
Tracking error	less than 2.5°
Stylus pressure adjustable range	0 — 2.5 g
Acceptable weight of cartridge	5 g — 11 g
Height adjustment range	39 — 43 mm
Cueing	oil damped system

General

Power consumption	17W
Dimensions	485(W) x 163(H) x 396(D) mm
Weight	Aprox. 11 kg

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Imagine being able to record *three hours* of music on a C-90 cassette with the kind of fidelity only Nakamichi can deliver. Wishful thinking? Not with the new Nakamichi 680 2-Speed Discrete Head Cassette Deck. In addition to the standard tape speed of 1⅞ inches per second (ips); the 680 is capable of record and play at half-speed, namely 15/16 ips. And what's really amazing is that the 680's performance at half-speed is equal to or better than that of many modern component-quality cassette decks running at normal speed! Especially when combined with the new metal particle cassette tapes, the 680 at half-speed provides more than ample dynamic and frequency range for the recording of high-quality commercial program material (disk or FM).

As you might imagine, there is some formidable technology embodied in the Nakamichi 680. This technology not only makes half-speed a reality, but also elicits the last ounce of performance from today's advanced tape formulations at standard speed.

Nakamichi

From CONVOY INTERNATIONAL, 4 Dowling Street, Wooloomooloo, Sydney. 2011.

twisted conductors or, when using two core mains leads, parallelled conductors so that the fields are reduced by cancellation.

If it can be established that hum is caused by some form of electrostatic breakthrough, but it is not practicable to move the offending cables, a form of shielding may be required between the mains cables and the signal leads. Any earthed metal should serve the purpose – provided of course, it does not contact any signal leads and thus set up an earth loop.

When turntable hum is the problem, a trick of the trade which works in a surprising number of cases (with turntables fitted with two pin mains plugs) is simply to reverse the two pin mains plug in the power outlet – whether at the mains or at the amplifier's mains outlet. By transposing the active and neutral conductors in this way, it is sometimes possible to reduce the field that may occur around a switch, or some other internal device which is sufficiently close to the pickup, or to signal leads, to cause problems.

It is also worth experimenting with different routes for the signal cables – keeping them well clear of any cables carrying mains voltages. Make sure that any mains conductors are kept well away from the pickup cartridge.

Magnetic induction

Transformers and electric motors operate within powerful magnetic fields which are generated by passing the ac mains current through the windings of a coil. It is very difficult to contain the magnetic fields that occur around transformers or turntable motors, and they tend to spread out beyond the immediate vicinity of the device. Any coils (including earth loops) or windings used in signal carrying components which do fall within the stray magnetic field, are very prone to hum pickup of this type;

The earthed shield used to prevent hum from electrostatic fields is unfortunately no barrier to a magnetic field, and special metallic shielding – such as mu metal – must be used.

The components which are most susceptible to magnetic hum induction are the pickup cartridge and the magnetic heads on a tape recorder – low level devices which rely on magnetic coupling for their operation.

Generally tape heads are shielded by the internal design and layout of the recorder's electronics. However, the pickup cartridge by its very design and performance requirements must be close to the turntable's motor. While most good turntable motors do not give trouble, cartridges do vary in their sensitivity to magnetic fields, and troubles may occur when least expected.

In spite of any design features or in-built shielding included to prevent the breakthrough of magnetically induced hum in turntables and tape decks, these units should be kept as far as possible from the power transformers of amplifiers, tuners and other components.

Curing magnetic hum

The most common problem with magnetically induced hum is found around the pickup cartridge. To cure this hum it is necessary first to establish the cause.

If you suspect that the turntable motor is the cause of the problem, try switching the motor on when the arm is at different points across the turntable. If the hum appears and disappears as the motor is turned on and off, then the motor is the culprit.

It will be possible to tell where the problem is worst, and the only cure in some cases will be to relocate the arm. If this is impossible, as it would generally be with automatic and semi-automatic arms, it is necessary to look to some form of magnetic shielding.

If hum levels change with the position of the arm across the platter – even with the motor switched off – it is probable that some nearby component is the cause – possibly a power transformer in the amplifier or some other component nearby. Try changing the position of the turntable relative to the other components – sometimes a slight change in orientation is all that is needed.

Similar experiments will be required if the hum occurs in a tape deck, although this is only likely to occur when the equipment is mounted in a confined space such as an equipment cabinet.

Halting hum

The search for the source of a hum may take a great deal of your time and when hum problems do arise, you must be prepared to devote several hours to the hunt. It is certainly worth while – you will not get any easy listening until it is found.

Remember that hum rarely comes from a faulty component so it is unlikely that you will banish it simply by buying replacement components.

Run through the major causes in a logical way and you should strike the root of the problem – eventually. But then you could always be lucky and find the source first time.

If hum does strike, don't close your ears to it and pretend that it's not there. It is a problem that has embarrassed many professionals, so if it strikes you, you'll be in good company! ●

Hum loops can be quite frustrating !

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sound business

THE OTOSCAN 3B is the latest loudspeaker from Colin Wait Acoustics, joining the enormously successful Otoscan 1 and its smaller stablemate, Otoscan 2, to form a first-class series of up-market speakers for the serious listener.

The 'B' in 3B stands for Benson, none other in fact than Dr. J.E. (Ernie) Benson who, over the years, has been responsible for many of the excellent speaker designs from AWA (including those marvellously clear public address columns at Sydney Opera House). He has written prolifically on his subject through AWA's Technical Journal and various institutional technical journals. So prolific is Dr. Benson's writing that KEF's Laurie Fincham, who has steered this well-known British manufacturer along a new course in the past few years by swinging into a complete loudspeaker bias, baulked at photocopying in excess of 300 pages (!) of information in London and requested reprints via Professor Small at Sydney University.

It is probably fair to say that Dr. Benson is Australia's foremost loudspeaker designer. He is certainly highly respected throughout the world.

For many years he has concentrated upon the use of omnidirectional speakers as sources of 'ambience' in the listening situation, and his research in this direction has led to the inclusion in the Otoscan 3B of an 'ambient source generator' – a 110 mm drive unit facing downwards and radiating omnidirectionally in the horizontal plane. This unit is attenuated by some 10 dB relative to the rest of the system so that its output is almost inaudible below the main sound, yet it is claimed that the 110mm driver improves stereo definition. Certainly the samples of Otoscan 3B that I've heard so far can provide a very stable and precise imaging characteristic and I am assured that disconnection of the omni driver degrades this capability.

In other respects the Otoscan 3B is more conventional. Front-mounted, forward-facing drive units are used in a three-way configuration, using a critically aligned reflex loading for bass as proposed by fellow Australian Neville Thiele, and a crossover filter network incorporating Linkwitz-Riley fourth-order (24 dB/octave) filters.

This appears to be the first commercial application of the Linkwitz-Riley Filters, and Dr. Benson confesses to have felt in the early days of 3B development that Linkwitz-Riley was the total answer for crossovers. In admitting that his views have now changed; the sound seems to be better, by and large, using second-order slopes for the lower crossover point (i.e. bass to midrange). I found the speakers, whether fitted with full fourth-order networks or half-and-half, 24 dB/12 dB networks, had a tireless yet full quality. It was not really possible to make a reasonably reliable conclusion about which type sounded better because of different ancillaries (pickups as diverse as SME/V15-1V and Grace 707/Supex) and time lapses, but I think the latest fourth-order/second-order system just has the edge.

The fact that Dr. Benson made extensive use of a Macquarie University computer during 3B development is an indication of the critical nature of design.

by Richard Timmins

Clearly, such a product could hardly be regarded as a 'backyard, bang-'er-in-a-box' device, the description seemingly popular for Australian high fidelity equipment, particularly speakers. Colin Wait's experience includes design and manufacture of the AMW4100, a loudspeaker which is already a minor classic in its original four-way form and one which seems destined to become hi-fi buff's legend. Add to this Dr. Benson's wide experience and sprightly, fresh attitude, tempered by a cautious, let-me-see-the-maths rigour, to a common conceptual philosophy and you have a design team of importance. The impression that emerges reveals confidence, yet with the ability to accept valid corrections. This is to say that listening is the true test, even though performance characteristics can now be very exhaustively calculated and tested.

A further interesting feature of the 3B is a piezoelectric HF unit. This is the latest version of the Motorola design and is a wide dispersion type. Used in conjunction with the Linkwitz-Riley filters, it gives a smooth transition from the sealed, 100 mm midrange driver without time-delay distortion despite the different relative planes of the two diaphragms. The audible result is

Colin Wait's latest Otoscan speaker – the 3B, designed by Dr J.E. Benson.

accurate dynamics, giving a sense of depth and front-rear space from appropriately recorded material

This speaker, particularly, has caused me to reassess my reasons for disliking reflex enclosures in general. The secret, according to Benson, is taking the enclosure alignment to an extreme degree of accuracy. The compromise involved in reflexing – the main drawback being the phase discrepancy at resonance frequency of the system, implying a modification of amplitude – has in this design become much more favourable overall, and all the advantages of reflexes including extended bass from a small enclosure, and minimal low-frequency non-linear distortion due to the reduction of diaphragm excursion at frequencies about the resonant frequency, certainly justify its use. Nevertheless, I feel bass performance of the 3B is not quite as good as that of

– continued on page 161. ▶

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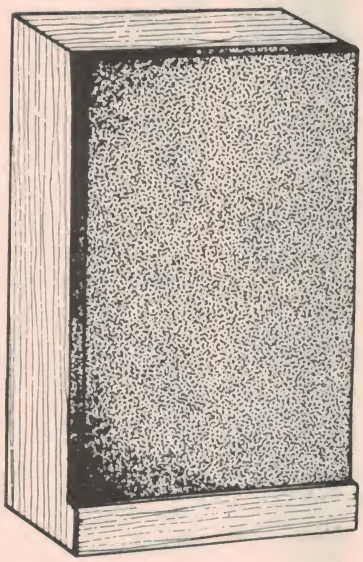

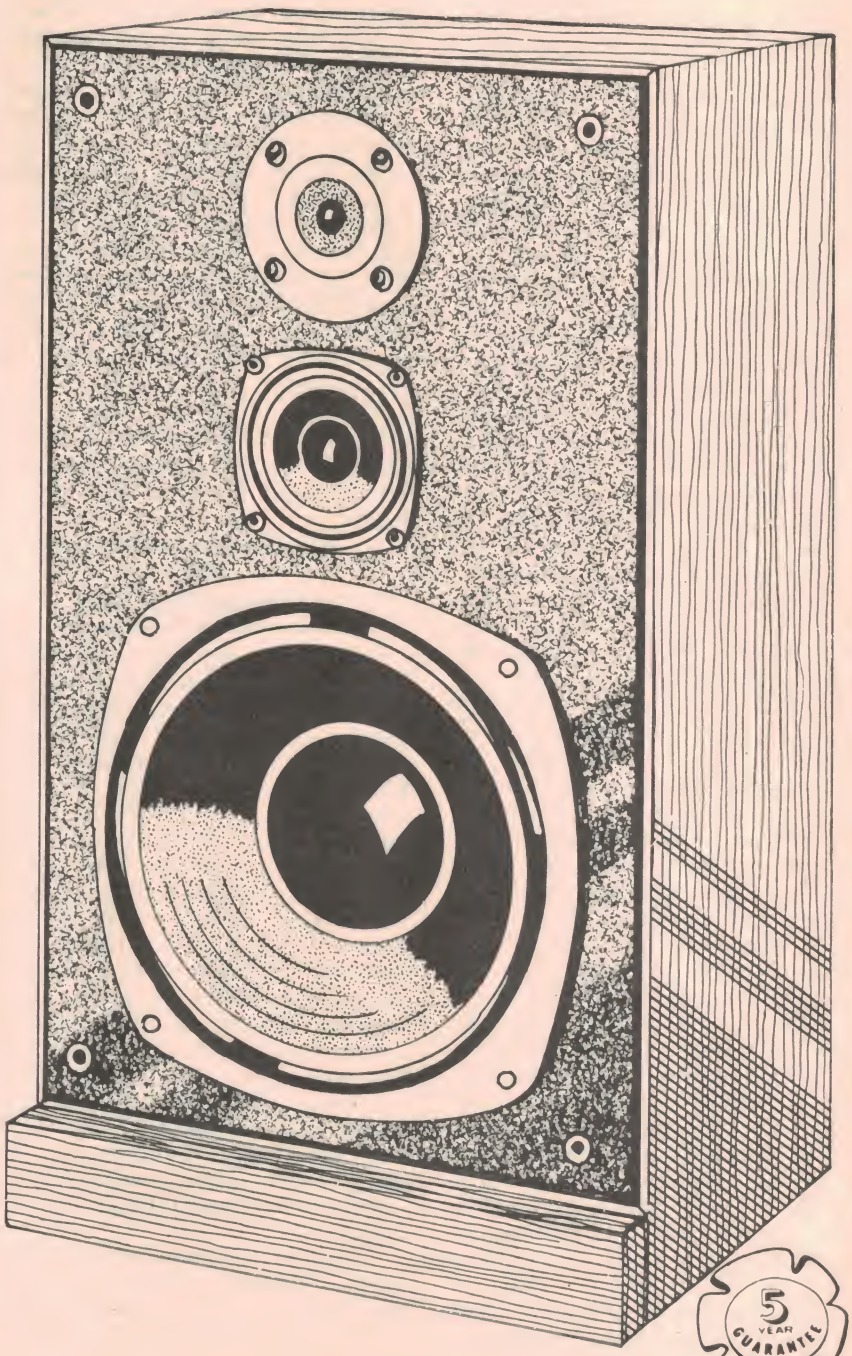

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sound business

my own transmission-line systems, or indeed as that of the controversial Linn Isobariks.

I have not yet had an opportunity of comparing the 3Bs directly with either my own speakers or the latter at this stage, although I would say the 3B's rival the Linns for definition of detail yet lack their curious warm colouration.

Otoscan 3B is now in full production, after lengthy final adjustment trials during which it was decided to abandon the fourth-order filters at the lower crossover point. This underlines the need for a sensitive approach to loudspeaker design; although the fourth-order network appeared to offer best performance in theory, listening revealed certain performance deficiencies which could be overcome by use of a second-order network. Compromise was again involved here; the trouble with speakers is that striking the right compromise is extremely difficult. But all in all, the Otoscan 3B is an impressive design, one of the world's most advanced systems and one which offers superb sound from good ancillaries.

More digital

Philips' introduction of an effective, low-price digital disc-playing system earlier this year is an undoubted landmark on the road to better sound. The system is based on a 100 mm disc, played from the inside out by a laser beam.

The player system, which at present would sell for less than $1000 on the local market, offers one hour of playing time from a single-sided disc. Double-sided discs will almost certainly be produced in due course.

The earlier Otoscan 2.

Philips are ready to go into production with the system, competing against two Japanese systems (including one already in production by Teac).

Digital systems offer unprecedented quality in terms of signal-to-noise ratio and distortion rivalling, and in some instances surpassing, the highest standards in analogue systems. However, the main hang-ups do not seem to be technical; attempts in the U.S. to define a single standard for digital disc systems have been seen in some quarters as a violation of the Anti-Trust laws aimed at preventing monopolistic enterprises. This is simply the start of what seems certain to become a long, drawn-out process involving legal difficulties while a suitable single standard is agreed world-wide. It seems unlikely that the recording industry will swing to digital discs until such a single standard, equivalent to the RIAA standards covering conventional analogue discs, is established — already the plethora of tape formulations for compact cassettes is seen as a decided drawback and the existence of several videotape formats is a very definite rein on sales.

It seems unlikely, then, that digital discs and hardware will achieve widespread acceptance for some time. We needn't dump our collections of analogue recordings just yet. I also feel that further technical development will not go amiss for, although the new digital systems work well in their prototype forms there are still certain areas needing attention — such as the need for adequate uniformity of the record/playback media. One drop-out and a digital tape recorder farts. And so, presumably, will disc-players given suitable circumstances; (although much less likely . . . Ed) there is obviously room for progress when a technique is still in its infancy and it is the responsibility of those manufacturers developing the new systems to establish and agree standards allowing as much future improvement as possible. ●

The new generation of factory-built or kit-set Peerless loudspeakers

It's true most speakers *look* alike and that price alone never tells the whole story. But now the new generation Danish-built Peerless loudspeakers give you a recognizable difference in sound quality – a difference that has set Peerless a notch above the others for over 50 years.

The range of new generation Peerless loudspeakers includes the fully assembled *PAS series* plus the money-saving *PLK kit-sets*. Both series contain drive units with the following characteristics.

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☐ Large ceramic ferrite magnets for high power handling. ☐ Specially coated cones reduce colouration to a minimum. ☐ Cones are supported by a single-roll foam or rubber surround to maintain excellent linear motion. ☐ Bass response is clean and tight at all listening levels.

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☐ Peerless crossovers use air-cored chokes for maximum power handling, and special electrolytic capacitors to ensure long term reliability. ☐ All components are mounted on fibreglass printed circuit boards for maximum durability, while coded clip connectors eliminate the need for soldering.

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The power handling capacity is high and conservatively rated at 100W RMS, however, due to the high efficiency of Peerless speakers, the recommended amplifier power is between 25-100W RMS.

Whether you settle for the smart timber-veneered PAS assembled series or the PLK kit-set, you're getting the same Danish-made Peerless quality – a quality selected by many of the world's most reputable names in loudspeakers, for inclusion in their own speaker systems.

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FOR sale ½ inch video tape Sanyo high energy (new) 2400 ft reels $10 each. R Beckett (02) 230.5169 BH. Penrith (047) 31.1793 AH.

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YAMAHA CT-800 AM/FM stereo tuner $120. Sudgen T48 FM stereo tuner $120. Koss ESP/9B electrostatic h/phones $80. Phone: Mike, after hours (063) 86.8201.

TEAC A-3300 SX 4 track 10½" NAB reel-to-reel. 3½ months old, perfect condition, hardly used, under guarantee. $480. Phone (02) 46.2385 — John Bawden.

SALE: Two ETI 480 Power Amps 50W or 100W in good working order. $40 each. Ring Louis Ziras (002) 34.3731 — Tasmania.

FOR sale: Vortex cassette tape mechanism with Nortronics head, unfinished kit for Pre-Pak recording and pre-amp. $40. Alan Pears (03) 531.4411 (AH).

COMMUNICATIONS

WANTED: Yaesu FT-7 or similar transceiver. 1.5-30 MHz. Good condition required. No extras required. Chris Heberle, PO Box 56, Mount Beauty, Vic 3699. Phone (057) 57.2133.

URGENT sale: GE A3-5825B AM/SSB. Excellent condition, 10 M coax 4 ft helical whip, power supply. Good buy. $140. (059) 89.2313 Mondays AH. C Holmes, Red Hill, Vic 3937.

CB AM transceiver wanted, any brand, Eilco 6801 preferred. Write with price, details, phone number to Bill Walker, C/- PO Airlie Beach, Qld 4800.

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MFJ longwire antenna tuner model 160/10, never used, cost $79.00, sell $65.00. 6M Pye T-ceiver working order $50.00. AH (03) 550.3212.

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WANTED: Sol-20 terminal computer 16k RAM. C Brown, 12 Holmes Street, Waimate, New Zealand.

MINISCAMP computer for sale. Assembled and working with ¼k and programming manual $80 ONO. Ring Grahame 498.3823 (Sydney) after 6 p.m.

SELL BASIC computer programs games, finance, maths. For details send 20 cent stamp to K R Dixon, 27 Beatrice St, Aitkenvale, Townsville, Qld 4814.

SELL MEK 6800 D2 assembled. ½k RAM, full buffering, manuals, extra books, software. $225 ONO. Ring (03) 749.2627 after 7 p.m. Ask for Mark.

TRS-80 program swap. Send your favourites on cassette (CLOAD or System) and we'll return ours. R Rider, 36 Osburn Drive, Macgregor, ACT 2615.

MOTOROLA 6800/D2, assembled, working, new, $230. EA low cost VDU in case with Honeywell keyboard $240. Contact M Dever (062) 49.3493 (W) or (062) 49.7171 (H). PO Box 181, Manuka, ACT 2603.

WANTED: Manual – Sharp PC1002 Prog. Calculator. Gordon Russell, FS 102 Palmer Place, North Adelaide, SA or phone (08) 267.3039. Will pay.

SORCERER owners: Join the Sorcerer User's Club of SA. Meetings monthly, Psychology Dept, Adelaide University. Swap programs, ideas, help. J Webber, 22 Delange Avenue, Banksia Park, SA 5091. 251.1731.

HP-25 Games Pack. Ten programs, biorhythm, klingon, hunt, target, memory game, etc. Complete listings and instructions $5. G Jones, 1/48 Carrington Road, Waverley NSW 2024.

TANDY TRS-80 computer level 2 with 16k memory, video monitor cassette recorder, power supply and all manuals $1000 ONO. Phone BH (03) 654.3548.

TRS-80 Owners: Light pen for your computer! $23. Communicate directly with the screen. Sample program included. Write C/- PO Box 122, Bondi Beach, NSW 2026.

TRS-80 Level One, 16k RAM, manuals, monitor, recorder, power supply, 6 cassettes full of programs. $987. TRS-80 L1 & L2 Software on cassette full documentation, Space Trek & Air Flight Simulation, $27 + $1 p & p. T Graham, 29 Blanche Drive, Vermont, Vic 3133. Phone 873.1845 3–6 p.m.

BAUDOT TTY: 1 working machine, 1 for spare parts. 2 manuals. $100. (03) 743.2845 (AH). Kurt Deininger, 62 Gretel Grove, Melton, Vic 3337.

FOR sale: TRS-80 software. Level I Basic Instruction Course $18. In-Memory Information System Levels I & II. $30 cassettes with original Tandy binder and documentation. Phone (02) 437.6681.

RS232 interface suit TRS-80. Drive printer or other RS232 compatible products - no expansion interface required. $65 including software listing and circuit diagram. Write C/- PO Box 122, Bondi Beach, NSW 2026.

SELL: Dream 6800 assembled and fully operational $330, power supply extra $75, TV monitor $50 – ask for Chris. Phone after 6 p.m. (02) 630.5816.

PRINTER (Phillips EUY-10EO23LE)including Duoprint controller & 2 paper rolls (see ETI Sept 78, EA Nov 78, EA Jan 79) new $240. M Keech, 220 Spit Rd, Mosman (02) 960.1624.

EXIDY Sorcerer with accessories, hardly used, for sale at substantially less than new price. Phone (02) 818.2872 after 6 p.m.

FOR sale: MEK6800 D2 assembled with power supply; card cage and backplane. Working well, no bugs. Full documentation $275. Phone (02) 498.2952.

TAPE interface, kansas, working, 100% reliable, ex DSE kit, CCTS, $20. No transformer, used to 300 Baud. (07) 261.2978 C Wlodarczyk, PO Box 139, Strathpine, Qld 4500.

TRS-80 Level I, 4k RAM system for sale. Ex. condition with software, instruction manual and reference handbook. For further details, phone (08) 79.8648. Price $590.

Z80 board S100 A&T less EPROM $150, 8 parallel 2 serial & cassette I/O board $170 both together make a good system at $300. IBM Selectric No. 735 I/O terminal needs a little attention $170 W/manual and interfacing info. R Pfotenhauer, PO Box 81, Lyneham NSW 2602.

SELL: 16k Exidy Sorcerer minicomputer, includes cassette recorder, video monitor and manuals. Worth $1,500 new. Best offer. Jim (02) 603.1041, Sydney.

MISCELLANEOUS

WANTED: Single channel radio control for garage door opener. Write to A Baur, 94 Esmond Rd, Pt Pirie, SA 5540. Phone: 34.4221.

SELL: Adcola Thermatic T30 soldering iron 40W, plus 3 tips. Brand new $34. W Schmidt, 44 North Rd, Avondale Heights, Vic 3034. Phone 337.9381.

FOR sale: Past issues of ETI. Most issues July '71 to Dec '77. Best offer. Alan Pears (03) 531.4411 (AH).

RADIO remote controls; single channel, quartz locked, digital encoded & CB immune. Several types available between $99 & $60. Many interface options & code alternatives. Phone Kris (02) 682.4015.

SELL: AM/FM radio, LCD calculator, multimeter, car alarm, CB base station 'Swamper' antenna, new reel tapes, all good, from $3. (02) 848.9713.

VARIAC 0-260V output at 20 amps maximum. Enclosed in square diecast case. As new condition $120 or near offer. B Mudd, Thomastown, Vic. Phone 465.9817.

SELL: 2 dozen capacitors, 900uF 100 vw high ripple current. As used in capacitive discharge welder. $25. B Mudd, Thomastown, Vic. Phone 465.9817.

CRO dual beam $45. CRO tubes 5CP1 5UP1 $15 each. Het freq meter $20. Teletype model 15 $40. Dearden, 15/26 Price St, Ryde. (02) 808.1244 or 807.4917 AH.

FOR sale: Paton VCT model ET3 with instructions and circuit $30 ONO. Joy Smith, 14 Jones St, Ryde, NSW. Phone 807.1374.

FOR SALE: LED Displays – set of four Hewlett Packard No. 5082-7302, as used in ETI-109 frequency counter/timer - very useful displays, inlcudes logic. $40 ONO.

FOR sale: Hewlett Packard distortion analyzer model 332A C/W service manual $850. Excellent condition. Phone Bill West (03) 874.4325 (Vic).

PLEASE USE BLOCK LETTERS		

TDK's HD-01 HEAD DEMAGNETIZER BUILT INTO A CASSETTE SHELL.

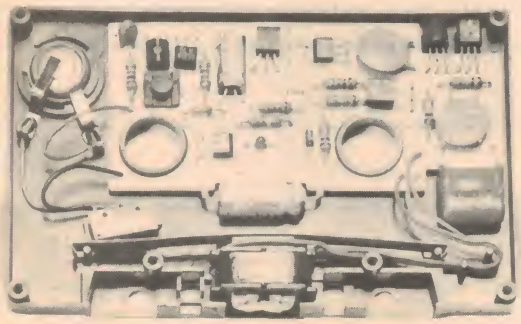
Simply load the HD-01 into any cassette recorder as you would a standard audio cassette and depress the 'play' button.

WHY IS DEMAGNETIZING SO IMPORTANT?

TDK, in conjunction with many cassette deck manufacturers, recommends that cassette decks be maintained on a regular basis. Cleaning the heads, capstan and pinch rollers is one important aspect of that maintenance program. — Periodic demagnetizing, about every thirty hours of use, is the other. Failure to do so will cause a build-up residual magnetism on the heads, which can seriously affect tape and machine performance in the following critical areas:

1. The noise level in the low and midrange frequencies is increased by 5 to 7dB, thereby reducing the overall signal-to-noise ratio.
2. Pre-recorded tapes can also be affected with midrange and high frequency distortion, as well as attenuation by as much as 2 to 6 dB, virtually eliminating any hopes for clear sound reproduction.

Record/Playback heads do generate a residual magnetic field over a period of time. This can be strong enough to act as an erase head, is capable of partial erasure of high frequency signals, and at the same time loads additional noise/hiss onto the original recording.
The interaction of these factors will not only prevent both the tape deck and tape from displaying their true performance capabilities, but will severely limit the Dynamic Range properties of both, rendering pure sound reproduction an impossibility.



The TDK HD-01 Head Demagnetizer features:

- A unique cassette format, designed to insure complete compatibility with any cassette deck.
- Powerful de-gaussing circuit instantly demagnetizes recorder heads the moment the play button is depressed, removing every trace of residual magnetism in only one second!
- A red LED (Light Emitting Diode) built into the HD-01 cassette shell will light up the moment your recorder heads have been completely demagnetized.

The TDK HD-01 Head Demagnetizer ends forever the fuss and mystique surrounding the demagnetization process and is much easier to use than conventional wand-type tools. Anyone can use the HD-01 and get perfect results every time.
The TDK HD-01 Head Demagnetizer is completely self-contained, battery operated and portable. It can be taken anywhere and stored with your present audio cassettes. The TDK HD-01 is ideal for all types of cassette decks especially those with heads located in hard to get at places such as:

— records with heads positioned in the front of the unit but which point to the rear.
— those with 'pop up' loading mechanisms which cannot be detached, thus making the heads almost inaccessible.
— cassette decks with heads positioned laterally with respect to cassette loading (car decks are good example of this type).
— automatic loading machines.

TECHNICAL DATA

Major Components:
Transistors (8)
Diodes (2)
LED (Light Emitting Diode)

Power Supply — Control Section — Oscillation Section — Head Section

Specifications:

Maximum Magnetic Flux Density	200 Gauss
Oscillation Frequency	630 Hz
Shape	(External Dimensions) Conform to IEC Standards
Battery for Power Supply	G-13 1.5 volt, Silver Oxide Battery (option)

TDK®

TDK (Australia) Pty. Ltd.,
4 Dowling Street,
Woolloomooloo. N.S.W. 2011
(02) 358-2088

Parametric Equalizer (Instrument Preamps) Mono and Stereo Models PQ-3 and PQ-6

EQUALIZED BY FURMAN SOUND

The Furman Sound Parametric Equalizer/Preamps are in the forefront of the growing trend for top quality components in modular, expandable musical instrument systems. They are economical, yet highly versatile and sophisticated tone controls which include preamps and regulated power supplies. Among their many uses are: as musical instrument preamps for use with either preamps or any conventional instrument amps; in a PA system for feedback suppression; or as patchable outboard equalizers for recording studios, broadcast stations or stage productions.

Because they are so simple and straightforward to use, the PQ-3 and PQ-6 have rapidly established themselves as a most effective means for bassists, guitarists, keyboards players and vocalists to achieve the tones they want by *pinpointing* the exact frequencies needed for the desired tonal color.

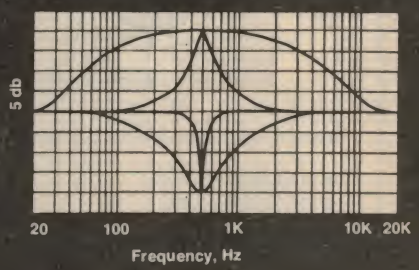
Parametrics are not limited by a fixed number of frequencies as are graphic equalizers. The Furman parametrics have three continuously variable and broadly overlapping frequency controls per channel so you can *zero-in* EQ exactly where you need it. Each band can be boosted by 20 db or cut by more than 40 db. Bandwidth controls allow you to select how wide a segment of the audio spectrum is to be affected by the boost or cut in any band, from as little as 1/10 of an octave to over four octaves. These ranges are greater than those available on any other parametric currently on the market.

Other features include: a level control to compensate for loudness changes caused by the EQ setting; an EQ bypass switch; high and low level inputs and outputs, with 1/4" phone jacks standard. Model PQ-6 is the two-channel version—that is, it is simply the equivalent of two PQ-3's in one chassis. Both models are 19" rack-mountable and are available in 115V, 60Hz and 230V, 50-60Hz versions.

Specifications

- Frequency ranges: Bass 25-500 Hz. Midrange 150-2500 Hz. Treble 600Hz - 10KHz.
- Equalization: +20db boost, - ∞ dB cut, all ranges.
- Bandwidth: Less than 1/3 octave to over 4 octaves ("Q" adjustable from 0.2 to 3.8)
- Input: 100K ohms unbalanced, with maximum input before clipping at 1 KHz, 430 mVrms for Low Level In; depends on setting of Level control for High Level In.
- Output: 10 ohms unbalanced, with maximum output level of 8.3 Vrms (+21 dbm) into minimum terminating impedance of 600 ohms.
- Total Available Gain: Low Level Input 26 db
  High Level Input 6 db (with EQ set flat)
- Frequency Response: + or - 1/2 db in Bypass or with all Equalization controls set to 0, from 20Hz to 20KHz.
- Signal to Noise Ratio: 109db in Bypass; 99db with EQ in and set flat, (noise measured with High Level Input shorted to ground, unweighted, from DC to 80KHz.)
- Distortion: .015% in Bypass; .025% with EQ in and set flat (T.H.D. measured at 1 KHz at +20 dbm and 600 ohm termination)
- Construction: Steel chassis; brushed and anodized 1/8 aluminum front panel; glass epoxy printed circuit boards.
- Dimensions: PQ-3, 1-3/4" H x 19" W x 8" D; PQ-6, 3-1/2" H x 19" W x 8" D; both mount in standard 19" rack enclosure.
- Weight: PQ-3, 5 lbs.; PQ-6, 8 lbs.
- Power Requirement: PQ-3, 4 watts; PQ-6, 8 watts. Both available in 115 VAC or 230 VAC models.

Equalisation curves, one band, centred at 500 Hz 20 db boost and cut, narrowest and broadest bandwidths.



Australian distributors:

DYNAMIC MUSICAL ENTERPRISES PTY. LTD.

Head Office: 66 Gibbes Street, Chatswood, NSW. 2067. (02) 406-5655.

Qld. Sales Office: (07) 399-2459.
Nth. Qld. Sales Office: (077) 73-2177.
S.A. Sales Office: (08) 352-6222.
W.A. Sales Office: (09) 330-1255
Vic. Sales Office: (03) 859-4973.

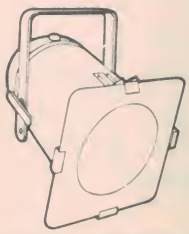
STAGE & EFFECTS LIGHTING

ALL YOUR REQUIREMENTS AUSTRALIA WIDE

BUY ONLY THE BEST AUSTRALIAN LIGHTING EQUIPMENT — MADE BY AUSTRALIAN'S FOR AUSTRALIAN CONDITIONS

PAR 56

The 300 watt sealed beam spot with greater candle power than a 1000 watt Fresnel spot — with 240V convenience.



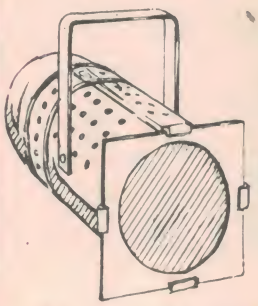
HOTSPOT

The ultimate pin spot for effects lighting, creating a narrow, solid shaft of visible light — as used by the Angels rock band.

ROCKBEAM

The most versatile, compact and highest output beamlight offered for sale in Australia, featuring a near-parallel beam, adjustable to a 1000 watt flood.

PAR 64 SEALED BEAM SPOTLIGHTS



The **PAR 64** is the standard lantern for every touring band in Australia, for several very important reasons :

OUTPUT: The **PAR 64** sealed beam lamp has an output far greater than most 1000W lanterns.

STRENGTH: The simple, hard-wearing construction of the **PAR 64** almost completely eliminates maintenance — a must for touring applications!

ECONOMY: **PAR 64** lamps are rated at an extraordinary 2000 hours lamplife — the highest life of any entertainment lantern! Considering some theatre spotlights have only a 250 hour life, the **PAR 64** can't be exceeded!

ALL UP, THE **PAR 64** IS THE STANDARD TOURING LANTERN FOR ROCK 'N ROLL — GET WITH THE STRENGTH!

- WINCHUP STANDS
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- DIMMER SYSTEMS
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- LEE COLOUR FILTERS
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- FOG MACHINES
- ALL DISCO LIGHTING

FOR **EVERYTHING** IN LIGHTING EQUIPMENT — **HIRE** AND **SALES** — CALL US!
THE NATIONAL LIGHTING SUPPLY ORGANISATION FOR PROFESSIONALS

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Bentley
(09) 361-8981
HOBART:
Tony Miller
25 Castray Esplanade
Battery Point
(002) 23-5150

KITS for projects

WE GET MANY enquiries from readers wanting to know where they can get kits for the projects we publish. This list is a guide to suppliers of kits and components for ETI projects.

We have only listed the projects published in the last two years, with their dates of publication, so this page can also be used as an index, even though kits are not available for some of them (as far as we know). Any companies who wish to be included in this list should phone Jan Collins on 334282.

Printed circuit boards

Those suppliers listed against specific projects here are able to supply pc boards for those projects. Printed circuit boards for every project ever published in ETI are available through the following companies (to the best of our knowledge):

RCS Radio — Radio Despatch Service
651 Forest Rd — 869 George St
Bexley NSW — Sydney NSW 2000

For current projects and a more comprehensive list of pc board suppliers refer to the Shoparound page in this and previous issues. This list will be updated roughly every four to six months.

Magnifying glasses may be bought at many general hobby shops, Newsagents and some stationary suppliers. Squint a little — it helps !

Key to Companies

- A — Applied Technology Pty Ltd, 1A Paterson Avenue, Waitara, NSW 2077.
- B — Bill Edge Electronic Agencies, 115 Parramatta Road, Concord (PO Box 1005, Burwood North 2134).
- C — J. R. Components, PO Box 128, Eastwood, NSW 2122
- D — Dick Smith Electronics P/L, PO Box 747, Crows Nest, NSW 2065.
- E — All Electronic Components, 118 Lonsdale Street, Melbourne, Vic 3000.
- F — Tasman Electronics, 12 Victoria Street, Coburg, Vic 3058
- J — Jaycar Pty Ltd, PO Box K39, Haymarket, NSW 2000.
- K — S M Electronics, 10 Stafford Court, Doncaster East, Vic 3109.
- L — Ellistronics, 289 Latrobe Street, Melbourne, Vic 3000.
- M — Mode Electronics, PO Box 365, Mascot, NSW 2020.
- N — Nebula Electronics Pty Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2011
- O — Orbit Electronics, PO Box 7176, Auckland, New Zealand.
- P — Pre-Pak Electronics, 718 Parramatta Road, Croydon, NSW 2132.
- R — Rod Irving, PO Box 135, Northcote, Vic 3070
- T — Townsville Electronic Centre, 281E Charters Towers Road, Rising Sun Arcade, Townsville, Qld 4812.
- V — Silicon Valley, 23 Chandos Street, St Leonards, NSW 2065.
- W — Willis Trading Co P/L, 993 Hay Street, Perth, WA 6000.
- Y — Trilogy, 40 Princes Highway, Fairy Meadow, NSW 2519

Project Electronics

041 Continuity Tester ..... W,R,D,B,T,Y,L
042 Soil Moisture Indicator ..... R, ,B,T
043 Heads or Tails Circuit (Oct 76) ..... W,R,D,E,A,F,B,T,Y,L
044 Two Tone Door Bell (Oct 76) ..... W,R,D,E,O,A,F,B,T,Y,L
045 500 Second Timer ..... W,D,E,A,B,T,Y,L
047 Morse Practice Set ..... W,D,O,A,B,T,Y,L
048 Buzz Board ..... W,D,A,B,T,Y,L
061 Simple Amplifier (Oct 76) ..... W,R,D,E,A,B,T,Y,L
062 Simple AM Tuner (Mar 77) ..... W,D,E,B,Y
063 Electronic Bongos ..... R,D,A,B,Y,L
064 Simple Intercom (Nov 76) ..... W, ,A,T
065 Electronic Siren ..... W,R,D,E,O,A,B,Y,L
066 Temperature Alarm (Dec 76) ..... W,D,E,A,B,T,Y,L
067 Singing Moisture Meter ..... D,B,Y
068 LED Dice Circuit (Oct 76) ..... W,R,D,E,A,B,T,T,L
070 Electronic Tie Breaker (Jan 77) .....
071 Tape Noise Limiter (June 78) ..... R, ,E,F
072 Two-Octave Organ (June 78) ..... W,D,B,Y
081 Tachometer (Mar 77) ..... W, ,E,O,T
082/528 Intruder Alarm ..... W,R, ,E,A,T
083 Train Controller ..... W,R, ,E,L
084 Car Alarm ..... W,R,D,E,A,B,Y,L
085 Over-rev Alarm ..... W,
086 FM Antenna ..... W,
087 Over-LED ..... W, ,E
088 Hi-Fi Speaker ..... W,

Test Equipment

132 Experimenter's Power Supply (Feb 77) ..... ,E,O
133 Phase Meter (Apr 77) ..... ,E
134 True RMS Voltmeter (Aug 77) ..... ,E
135 Digital Panel Meter (Oct 77) ..... ,E
136 Linear Scale Capacitance Meter (Mar 78) .....
137 Audio Oscillator (May 78) ..... W,D,E
138 Audio Wattmeter (Nov 78) ..... ,E,B
139 SWR/Power Meter (May 78) .....
140 1 GHz Frequency Meter-Timer (Mar 78) ..... ,C
141 Logic Trigger (Jan 79) ..... ,E
142 High Current Power Supply (Feb 79) ..... W, ,E
143 Curve Tracer (Jan 79) ..... W,
144 Expanded Scale RMS Voltmeter (June 79) ..... ,E
148 Versatile Logic Test Probe (July 79) ..... ,E,L

Simple Projects

243 8ip Beacon (Apr 77) .....
244 Alarm Alarm (Feb 77) .....
245 White Line Follower (Nov 77) .....
246 Rain Alarm (Apr 78) ..... ,F
248 Simple 12V to 22V Converter (July 78) ..... W,
249 Electronic Combination Lock (Apr 79) ..... ,E
252 The Passionmeter (Aug 79) .....
253 Electronic Grenade (May 79) .....
254 Egg Timer (June 79) ..... W,

Motorist's Projects

316 Transistor Assisted Ignition (May 77) ..... W, ,E,O,K
317 Rev Monitor Counter (July 77) ..... ,E
318 Digital Car Tacho (July 78) ..... W, ,E,K
319 Variwiper MK II (Sept 78) ..... W, ,E,O
320 Battery Condition Indicator (Apr 79) ..... ,E,L

Audio Projects

448 Disco Mixer (Nov 76) ..... W,
449 Balanced Microphone Amp (Nov 76) ..... W,D,E,J,F,Y
450 Bucket Brigade Audio Delay Line (Dec 77) ..... W, ,E
451 A Hum Filter for Hi Fi Systems (July 79) ..... D,E,F
455 Class A Headphone Amp (Nov 78) .....
470 60W Audio Amplifier Module (May 79) ..... W,R, ,E,F,B,P,L,A,V
471 High Performance Stereo Preamp Control Unit (June 79) ..... W,R, ,E,F,B,P,A,V,L
472 Power Supply — the Series 4000 Stereo Amp (July 79) ..... W,R, ,E,F,B,A,V,L
480 50-100 Watt Amp Modules (Dec 76) ..... W,R,D,E,J,O,A,Y,L
481 12V 100 Watt Audio Amp (May 77) ..... R, ,E,
481 High Power PA/Guitar Amp (June 77) ..... W,
482 Stereo Amp (Jan 77) ..... ,E
483 Sound Level Meter (Feb 78) ..... ,E
484 Simple Compressor Expander (July 77) ..... ,E,A
485 Graphic Equaliser (June 77) ..... W, ,E,J,O
486 Howl-round Stabiliser (Nov 77) ..... ,J
487 Audio Spectrum Analyser (Feb 78) ..... ,E
489 Audio Spectrum Analyser 2 (Apr 78) ..... ,E,J
491 Simple Graphic Equaliser (Mar 79) ..... W, ,E
495 Transmission Line Speakers (Aug 77) .....

Miscellaneous

546 GSR Monitor (Mar 77) ..... W, ,E
547 Telephone Bell Extender (June 77) ..... ,E
548 Photographic Strobe (May 77) ..... W, ,E
549 Induction Balance Metal Detector (May 77) ..... W,D,E,L
550 Digital Dial (Aug 78) ..... ,E,O
551 Light Chaser (Sept 78) ..... W, ,E,O
552 LED Pendant (Sept 78) ..... ,A
553 Tape/Slide Synchroniser (Oct 78) ..... ,E
557 Reaction Timer (Feb 79) ..... ,E
558 Mast-Head Strobe (Feb 79) ..... ,E
559 Cable Tester (Mar 79) .....
575 Portable Fluorescent Light Wand for Car, Camping (Aug 79) ..... W,
581 Dual Power Supply (Jan 77) ..... W, ,E,Y
582 House Alarm (July 77) ..... W, ,E,O,A,T
House Alarm — Installing (Aug 77) ..... W,
583 Marine Gas Alarm (Aug 77) ..... D,E,M
585 Ultrasonic Switch (Sept 77) ..... R,D,E,O,F,T
586 Shutter Speed Timer (Oct 77) ..... ,E,
587 UFO Detector (May 78) .....
588 Theatrical Lighting Controller (Nov 77) (Dec 77) (Jan 78) (Mar 78) ..... ,N
589 Digital Temperature Meter (PCB135) (Dec 77) ..... ,E
590 LCD Stopwatch (Oct 78) ..... ,O,N
591 Up/Down Presettable Counter (July 78) ..... D,E
592 Light Show Controller (Aug 78) ..... ,E
594 Development Timer (Apr 79) ..... ,E
595 Aquarium Lamp Controller (May 79) .....

Electronic Music

602 Mini Organ (Aug 76) ..... W,D,E,A
603 Sequencer (Aug 77) ..... W,
604 Accentuated Beat Metronome (Sept 77) ..... ,E
605 Temp Stabilised Log-exponential Converter (Sept 78) .....

Computer Projects

630 Hex Display (Dec 76) ..... ,E,A
631 ASCII Keyboard (Dec 76) ..... W, ,E,O,A
631 Keyboard Encoder (Apr 77) ..... W, ,E,O,A
632 Video Display Unit (Jan 77) ..... ,E,O,A
632 Video Display Unit (Part 2) (Feb 77) ..... ,E,A
632 Video Display Unit (Part 3) (Mar 77) ..... ,E,A
633 TV Sync Generator (Jan 77) ..... ,E,A
634 8080 Educational/Prototyping Interface (July 78) .....
634 8080 Educational/Prototyping Interface (Part 2) (Aug 78) .....
635 Microcomputer Power Supply (Sept 77) ..... ,O
637 Eprom Programmer (July 78) ..... W, ,E,A
639 Computerised Musical Doorbell (Mar 78) ..... ,A
640 S100 VDU (Apr 78) (May 78) (June 78) ..... ,A
641 S100 Printer (Sept 78) ..... ,O
642 16k S100 RAM card (Feb 78) ..... ,K
650 STAC Timer (Feb 79) ..... ,E,A,L
651 Binary to Hex Number Converter (June 79) ..... ,E

Radio Projects

712 CB Power Supply (June 77) ..... W, ,E
713 Add-on FM Tuner (Sept 77) .....
714 VHF Log-Periodic Antenna (Feb 78) (Mar 78) .....
715 VHF Power Amplifiers (Nov 77) .....
716 VHF Power Amplifiers (Jan 78) (Feb 78) .....
717 Crosshatch Generator (May 78) ..... W,D,E,A,Y
718 SW Radio (Oct 78) ..... ,E
719 RF Field Strength Indicator (Nov 78) .....
720 2m VMOS Power Amp (Jan 79) .....
721 Aircraft Band Converter (Mar 79) ..... W, ,E
722 Antenna for Aircraft Band Converter (May 79) .....
724 Microwave Oven Leak Detector (July 79) ..... D,E,B
725 Simple SSB Generator employs Polyphase Network using Standard Components (Aug 79) ..... ,E,L

Electronic Games

804 Selectagame (Nov 76) ..... ,O
804 Selectagame (Rifle Project) (Mar 77) ..... ,O
805 Puzzle of the Drunken Sailor (Oct 77) .....
806 Skeet (Jan 78) ..... ,O
810 Stunt Cycle TV Game (June 78) ..... D,O
811 TV Tank Game (Oct 78) ..... O
813 Race Track Game (Jan 79) ..... ,O
814 The 'Dinky-Die' (Aug 79) .....

DREGS

The 42 minute journey to anywhere

If you wish to make a journey it is often wise to take the shortest possible route. However, the shortest route between distant places is not across the surface of the earth but through a tunnel joining the two places concerned! If you wish to travel from Sydney to say, London, a straight tunnel through the earth is the shortest distance.

Suppose such a tunnel could be made — how would one travel?

One might imagine that one could travel in a pressurised train held in an evacuated tunnel (to eliminate air resistance) by magnetic levitation. As soon as the brakes of the train are released, it will fall towards the centre of the earth with continually increasing velocity without the need for any external energy. After passing near to the centre of the earth, the train would slow down as it rose towards the surface of the earth until (with only a little magnetic energy to assist it) the train reaches the surface of the Earth. How long would such a journey of about 7000 miles or 11.260 km take when travel is by free fall? The time works out at about 42 minutes.

But suppose one wishes to travel between two cities not on opposite sides of the earth. Sydney to Honolulu or Tokyo, for example, or London to Paris or Sydney to Perth.

One could (at least in theory) still construct an evacuated tunnel between any of these cities, but as the train would not fall directly towards the centre of the earth, the acceleration would be much less. On the other hand, the journey would be shorter. It is very strange that the smaller acceleration and shorter journey always produce a constant travelling time of about 42 minutes by the shortest direct path through the earth. This type of travel would clearly only be useful for fairly long journeys, since it would be too slow for short journeys.

What are the chances of us ever being able to travel in this gravity propelled way if frictional losses can be reduced to virtually zero? There are certainly many problems, especially those concerned with the construction of evacuated tunnels through the centre of the earth! Up to the present time man has not been able to make borings more than about 20 km deep into the earth, so to make holes some 5600 km deep from each side of the earth to meet near the centre of the earth is doubtless impossible with our present engineering techniques.

There are unfortunately, other problems, even if a suitable tunnel could be constructed. For example, the temperature near the centre of the earth is very high indeed — at least red heat — and this is hardly suitable as an environment for people to pass through even for a few seconds, nor for workers constructing a tunnel. Cooling the region near to the tunnel would present a difficult problem.

In addition, movement of the rocks and larva deep inside the earth would probably break many tunnels. How many people would risk this form of travel knowing that any movement of the earth could result in them being projected at an extremely high velocity into red hot solid rock or molten rock?

Although the idea of travelling to anywhere on the earth's surface by a 42 minute journey with little energy other than gravity looks very attractive in principle, it seems most unlikely that it will ever be possible in practice — but who knows what ideas may be used if the cost of petrol continues to rise at its recent rate!

Brian Dance

We are indebted to the Martin Marietta Aerospace company, Denver Division, of Colorado in the good 'ole US of A for this month's picture. We don't know what the object is either.

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